IBM

Dallas
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Technical
Bulletin

Extended Link Fault Identification and Diagnostic Aid

by: C. C. Aultman
E. M. Mayer
J. S. Petty

Edited by:
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G320-5945-0
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LIST OF ILLUSTRATIONS

ABSTRACT

This document provides detailed problem isolation and identification procedures to solve telecommunication problems using the abilities of IBM 3863, 3864, and 3865 modems and the NPDA Version 2 program product. It could have been titled: 'Getting the Most Out of Your IBM Modems and NPDA'.

PREFACE

This first edition replaces preliminary copies dated December 1982 and earlier and is nearly identical to the preliminary version dated April 7, 1983. The flow charts have been clarified by changing decision blocks with two decisions to two separate decision blocks and by changing wording. Also, we have added an appendix which shows the step by step analysis of a complex telecommunication problem.

ACKNOWLEDGEMENTS

We are especially grateful to Virginia Lynn who typed all the text and to Valerie Ford and Arlene Byles who created all the flow charts. Also, we thank Dennis Noto. This document could not have been created without his drive and enthusiasm.

CHAPTER 1: ORGANIZATION

FOREWARD

This guide has been prepared to allow the gathering of additional data about impaired non-switched communication lines and to aid reporting of errors to the communication vendor. It could have been entitled, "How To Get The Most Out Of Your Modems And NPDA".

The guide is general in its approach to problem solving and should be tailored for application to the specific problem determination and management procedures of individual customers.

The guide is organized into five general presentations. Background information about IBM products NPDA and 3863, 3864, and 3865 modems that relates specifically to line problem determination is located in Appendices B, C, and D.

Appendix A is the second presentation which describes the preparation and installation procedures customers must follow to make this document usable and useful.

The third presentation is Chapters 2, 3, 4, and 5 of this document. Chapters 2, 3, and 4 contain descriptions of the flow charts and instructions on how to use them. Chapter 5 contains the actual flow charts which are used to:

- Verify telecommunication problems
- Isolate communication wire pair and line segment
- Provide line impairment classification

Chapter 5 also has information about how best to report problems to telecommunication vendors.

Fourth are quick fix ideas and shortcuts presented in Chapters 6, 7, and 8.

Appendix F, which contains a sample problem and diagnosis, is the fifth presentation.

There is also a glossary of terms and abbreviations which may be helpful.

It is recommended that the user read through the complete document once before attempting to use it for the first time. The information is a cumulative presentation, although some particularly important information is repeated for emphasis or clarity. After this first reading the user can, with the table of contents, establish which sections are reference material and which are working documentation for his individual situation.

INTRODUCTION

This guide is presented as a supplementary tool to provide additional information about communication line problems when using IBM 3863, 3864, and 3865 modems and the IBM NPDA program product.

This tool presumes a user with a working knowledge of NPDA Version 2 and the various NPDA screens required to review data collected about NPDA identified communication line problems. Some VTAM commands are also used in this analysis.

In any telecommunications network, there are users at a remote location who need to communicate with some program or database at a central site. Located between the user and his central site goal are a central site communication controller and modem, a telecommunication line, a remote site modem, and some remote site controller/terminal arrangement usually in one or two packages. When the remote user can not communicate with the central site, the person or group managing the telecommunication network must identify the failing network entity and get it fixed as quickly as possible. This guide extends the ability of NPDA to identify the failing entity and will often show more precisely the actions required to fix the failing entity especially if the failing entity is a modem or telecommunication line.

It is intended to be used by telecommunication oriented "Help Desk Operators", Network Operations, and Communications Technical Support personnel as a supplement to the NPDA procedures. Operators using this guide should be able to more effectively communicate information about communication channel problems to the vendor or group responsible for providing this service allowing faster channel restoral and an effective early warning of potential problems.

PURPOSE

This guide is written to help the IBM systems management user understand better and correct communication network problems associated with installed communication lines, using the IBM 3863, 3864, 3865 modems and NPDA Version 2.

The goals of this guide are: First, to provide problem isolation to the communication line segment and wire pair (direction) where failure or degradation has or is occurring. Second, to provide additional detail on the line impairment causing the communication problem, i.e. the problem is intermittent (transient) or continuous (steady state) impairment or open line.

A basic premise for the use of this guide is that NPDA has identified that a resource (analog line) failure has caused a permanent error. A second possibility is that the user set threshold levels for either traffic or errors, have been exceeded causing an E/T Ratio Alert, ("E/T" is Error to Traffic).

Another or third possibility is that you are simply investigating line performance or measurement information and no alert has been triggered. The information presented is based on satisfying the first two possibilities but may also be useful in the situation where no alert has been triggered.

A second premise is that the guide is used when the problem is present. However, this guide will usually work well in cases such as a telecommunication line which fails for two hours overnight but is functioning well when the help desk opens the next morning.

CHAPTER 2: INTRODUCTION TO THE FLOW CHARTS

FLOW CHARTS STRUCTURE

The flowcharts are based on use of NPDA V2 alert and statistical data screens and an assumed leased 3002 unconditioned line using either point-to-point or multipoint configurations. The primary intent for these flowcharts is to provide supplemental information on:

1. Failure of Station - (PERManent Error) - reactive

2. Error to Traffic Ratio % exceeded - predictive

The flows can also be used to investigate situations of:

3. Poor Line Quality - reactive

4. How Is a Given Station/Line Running - investigative

The flow charts are organized to allow reaction to an NPDA alert in the following processes:

Chart A-E IDENTIFICATION OF FAILING ENTITY in the network (line, modem, terminal), screening to assure probable telecommunication failure, and whether the telecommunication line is open.

Two paths (F, G) are available for wire pair and line segment determination depending on whether the "normal" data is available on LQ (Line Quality) and HIT (Hit Count) for the network.

Chart F,G WIRE PAIR OR DIRECTION determination is made by using the LQ and HIT current data.

Chart H FAILING SEGMENT IDENTIFICATION of a multipoint non-switched link is done with current and normal LQ and HIT values or with E/T ratios if the "normal" data is unavailable.

Chart I-P OPENING, TRANSIENT, OR STEADY STATE IMPAIRMENT is determined using LQ hit count data from full speed and half speed operation.

An alert analysis form is suggested for recording the NPDA station and alert data used in the various above steps.

WHEN SHOULD THE FLOW CHARTS BE USED

The flow charts should be used when an alert occurs which might have been caused by a failure of a telecommunication line. The flow charts can also be used when a problem is reported via some other method than a NPDA alert (for example with a phone call). However the first step in such a case must be to find the alert which applies to the problem as this identifies the time at which the problem occurred. If no alert can be found, most likely the problem was not caused by the telecommunication line.

You should leave any idle help desk terminals with the NPDA Alert Dynamic screen active. When a new alert is posted to the screen, the help desk operator can decide whether to use this document immediately and can frequently identify the proper action to take without any keyboard entries. Listed below are some alert types that can be caused by telecommunication line failures for which the flow charts should be useful. A second list shows alert types which are usually not related to telecommunication line or modem problems. When in doubt, try the charts.

- Alerts Than Can Be Caused By Telecommunication Line Errors

  Remote Modem - No Response
  Remote Modem - Bad Response
  Modem Powered Off
  Poor Line Quality
  Error to Traffic Ratio Exceeded

- Alerts That Are Usually Not Caused By Telecommunication Line Errors

  SDLC CMD Reject
  Power Off Detected: Device
  Format Exception SDLC ROL
  Streaming Condition
  DTR Drop

CHAPTER 3: DESCRIPTION OF THE FLOW CHARTS

IDENTIFICATION OF FAILING ENTITY

CHART A

Chart A begins the process of identifying the failing entity by sorting the alerts. The eight or so words that are posted on the alert screen describe the alert and list probable causes. The information is very condensed; the flow chart shows whether the problem is in the telecommunication line based on the wording of the alert. For more information, see "Getting the Most Out of Alert Messages" on page 47.

If the alert is one which could have been caused by a telecommunication line problem, Chart A specifies that a solicited link status command be executed. This command is used primarily to determine whether the remote end of the line can be contacted.

CHART B

If the remote modem cannot be contacted through the service speed solicited link status command, Chart B determines the cause. The possibilities include failing modems, an open or severely impaired telecommunication line or a problem between the central site 3705 communication controller and the central site modem.

CHART C

Chart C is used if there is at least a local (central site) modem response to the LS command of Chart A. Chart C classifies several of the possible LS command responses. Chart C is the last chart to use the LS command of Chart A.

CHART D

Entry into Chart D implies that NPDA can contact the local modem and most of the time at least one remote modem on the line. In Chart D, the network analyst fills out an alert analysis sheet which is a way of creating a one page picture of the IBM modems' perceptions of the quality of the complete telecommunication line at the time of the failure. This "snapshot" of the line is used for all further analysis. Chart D also checks for the presence of a "streaming" modem or terminal.

DIRECTION DETERMINATION

The phrase "direction determination" refers to the problem of deciding which wire pair is impaired; transmit or receive. This is also called the transmit "side" or receive "side" of the line. Regardless of the choice of terms, it is necessary to specify the end being used as a reference point to remove the ambiguity caused by the fact that the transmit side of the line at one end is always the receive side at the other end.

CHART E

Chart E shows how to decide which side of a line is failing when the line is open.

CHART F

When "normal" (defined below) data is available, the simple Chart F is used to determine which side of a line is impaired. "Normal" data is Hit Count (HIT) and Line Quality (LQ) data about a line when few or no data errors were occurring. See ""Normal" Data" on page 10.

CHART G

When no "normal" data is available, Chart G is used to determine which side of a line is impaired. Typical cases when "normal" data is lacking are: 1) new telecommunications lines that are impaired when they are first installed; and 2) a line failure that occurs immediately after the NPDA data base is purged. Another situation that can prevent acquisition of "normal" data is an incorrect NCP gen. See "NCP Gen Parameters" on page 53.

SEGMENT DETERMINATION

A telecommunication line "segment" is a leg of a telecommunication line that can be differentiated from other legs of the same line. A point to point line has only one identifiable segment; using only the ends of the line where the modems are located it is impossible to determine the physical location of a failure.

The situation is different for a multipoint line - see Figure 1 on page 7 below. Suppose remote drop A is experiencing errors but drops B and C are not. This argues forcefully that the physical location of the line impairment is between the remote drop and the bridge where drop A joins the rest of the line because if any other line segment were impaired, either drop A would not be affected or more than drop A alone would be affected.

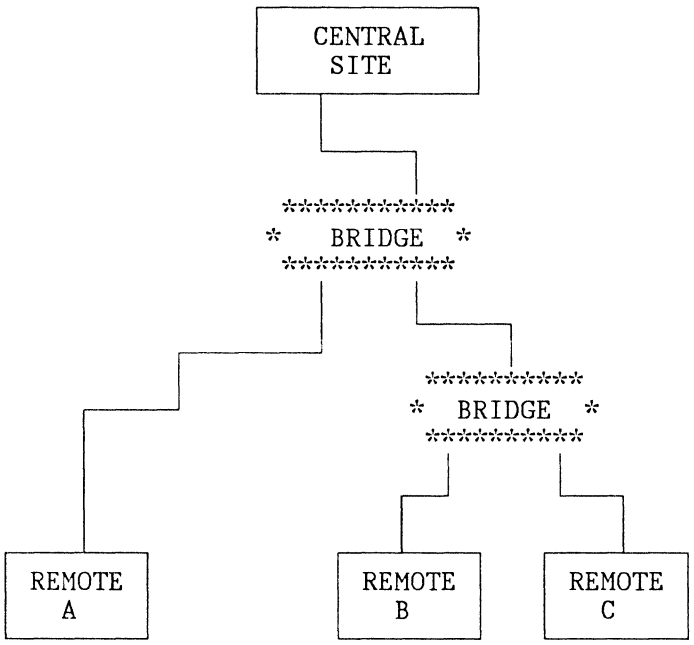

Figure 1. Multipoint Line

Note that the figure shows a line with 5 segments (or legs) even though there are only three drops on the line.

CHART H

If a topological map of the line is available showing bridge points, Chart H can be used to determine which segment/leg is impaired.

IMPAIRMENT DETERMINATION CHARTS I-P

The remaining charts are used to determine the analog line impairment. The reason there are seven charts is that the 3863, 3864, and 3865 modems all respond somewhat differently to impaired lines. For more detailed information see "Appendix B: Line Parameters and Their Effect" on page 61.

OVERVIEW OF FLOW CHARTS

The figure below shows the total problem investigation flow. A key need is the presence of an NPDA alert. Without an NPDA alert it is very difficult to find the failing entity in a network. (See "No Alert" on page 52.)

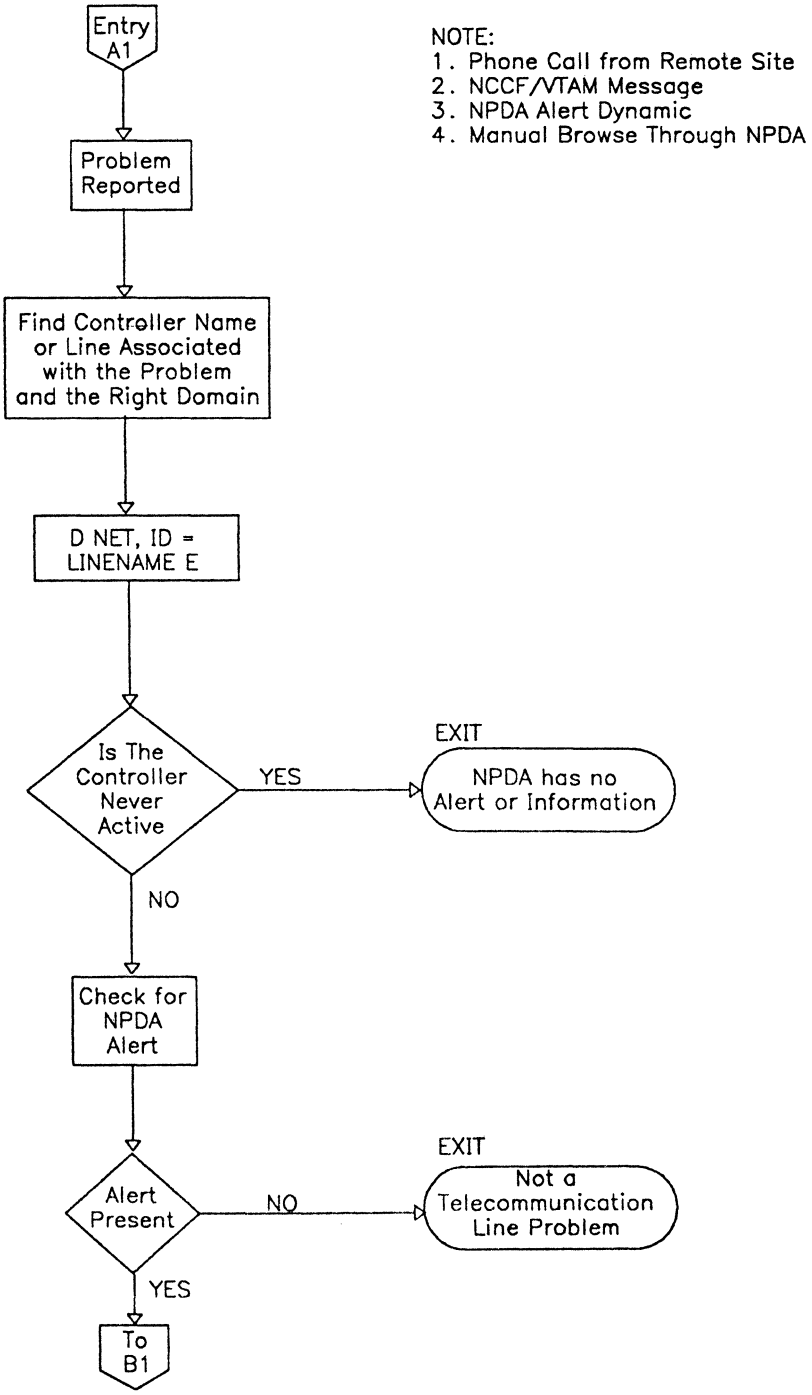

Figure 2. Problem Determination Overview

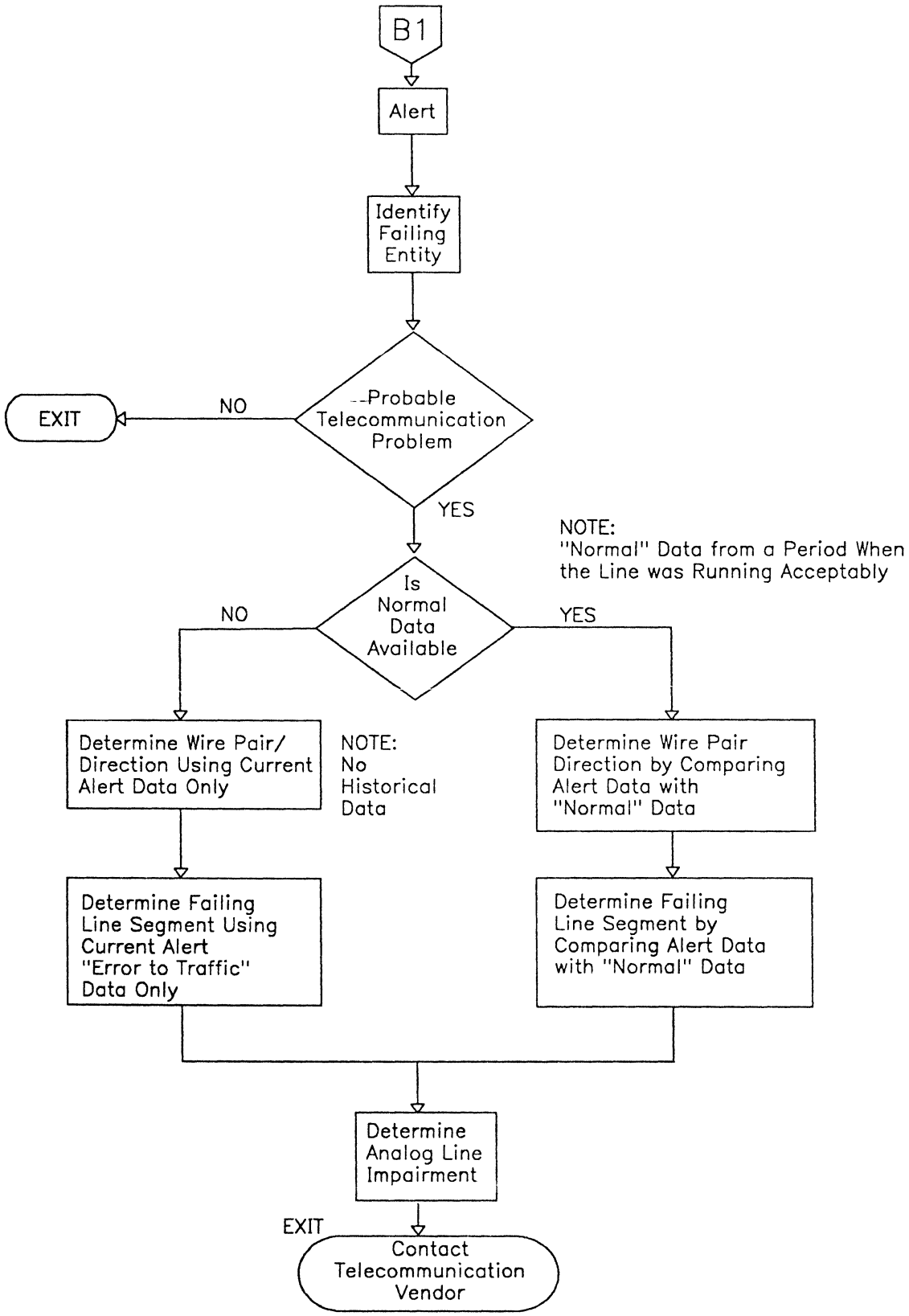

Figure 3. Problem Determination Overview (continued)

HOW TO USE THE FLOW CHARTS

If the user action to resolve a communication problem has been started by something other than an NPDA alert on a specific station (controller) some preliminary information is required. Examples of situations where stations are unidentified are:

- Alerts to a line
- NCCF/VTAM messages
- Telephone calls from application/terminal users

In the above mentioned examples it is necessary to identify the controller and/or line name and the specific domain involved.

The status of controllers attached to a given line can be determined by using the following VTAM command.

```
D  NET,ID=Line Name,E
```

Line name must be determined and should be recorded on the alert analysis record.

If the controller in question is in a never active condition, NPDA has neither alert nor information about the problem and these techniques cannot be used.

If the controller status is other than never active, an alert must be present to reliably use the techniques of line analysis in the following charts. The techniques can be used without an alert given the capability to use solicited NPDA commands for gathering the required LQ, HIT and calculated E/T ratio data.

"NORMAL" DATA

"Normal" data is found on the additional most recent statistical data screen. It consists of Hit Count and Line Quality for a controller when the controller was not experiencing errors. The line segment and line direction analyses are simpler and more accurate when "normal" data is available.

"Normal" data can be maintained in the NPDA or INFO data base or it could be manually recorded on topological line maps.

WHICH FLOWCHARTS TO USE

Initially you should use all the flow charts unless the line you are investigating is point-to-point. If so, skip flow chart H. Figure 14 on page 28.

As you gain more experience, you will be able to skip more flow charts. See "Chapter 7: Short Cuts and Hints" on page 47.

Also, there is a quick fix flow chart which will not solve all problems but which is significantly shorter than the main flow chart package. The quick fix flow chart should be used only by people who are familiar with the concepts in the main flow chart package.

CHAPTER 4: THE ALERT ANALYSIS SHEET PURPOSE AND DESCRIPTION

The alert analysis sheet is a data collection and single recording location for the information required to use flow charts D and beyond. Since the data required is found on many screens (NPDA, VTAM), it is more convenient to have it recorded on a single sheet.

Detailed instructions for filling out the sheet along with a sample page follow.

ALERT ANALYSIS SHEET INSTRUCTIONS

1. Record the alert date, time, and description from the NPDA ALD or ALH screen.

2. Record the alert "resname" from the ALD or ALH screen. The "resname" is either a controller/terminal or a line name.

   a. controller name - Do VTAM command "D NET,ID=controller" or equivalent to find the line name and then do B.

   b. line name - Do VTAM command "D NET,ID=linename,E" or equivalent to get the status of all the controllers on the line.

3. When chart A requires you to do a solicited LS command, record the time shown on the result screen.

4. Record the controller names on the sheet and the status of each one. (Only record one controller name per remote modem.)

5. Before proceeding further, check the dynamic alert screen (NPDA ALD) to see if additional alerts have been posted against this line or these controllers. If any "Error to Traffic Ratio Exceeded" alerts are posted against these controllers since the original alert or no more than five minutes before the original alert, record "y" for the controller(s) in the E/T column.

6. Record hit count (HIT), line quality (LQ), carrier detect loss (CDLST), and reinitialization (RINT) data for all controllers that have their E/T ratio above the threshold. You may know of some controllers that exceeded the E/T threshold because alerts were posted but other controllers with high E/T may not show an alert especially if the alert under investigation had a line name as its resname. Check the "unalerted" controllers' most recent statistics screens (NPDA MR ST N controllername) to see if the E/T ratio was exceeded near the time of the alert or alerts. Record "Y" or "N" and the ratio in the E/T column for each controller to show whether the controller exceeded the threshold. If there is no E/T information for a controller during the time of the alert enter "U" for unknown.

7. Record the HIT (per 15 minutes), LQ etc. for each controller with "Y" or "U" in the E/T column. Use the Additional Most Recent Statistics screens for controllers that have "Y" in the E/T column ((NPDA A after NPDA MR ST N controllername). If the alert is current, as opposed to a problem that occurred last night or last week, the solicited link status command can be used to collect the information for controllers that have a "U" for their E/T entry (NPDA TEST ncpname controllername LS).

   Note:

   a. Hit count must be recorded as the number of hits per 15 minutes. If you use the LS test to collect the data, run the test at least twice - once to zero the counter and then a second time after a known interval of at least 5 minutes. For example, if 3 hits occur during a 5 minute period, the hit rate is 3 X 3 = 9 hits per 15 minutes.

   b. If possible, collect enough data to enter "typical" numbers. For example, hit counts of 7, 8, 9, 9 per 15 minutes should be entered as 8. Successive line quality results of 7, 7, 8 should be entered as 7.

Average the readings after discarding exceptionally high and low values.

c. If the local and/or remote data is unavailable for a controller (blanks on screen, messages of bad or no response, etc.) enter "blank" in the local and/or remote area of the sheet.

ALERT ANALYSIS SHEET

1) Alert Date/Time/Description_____

2) Alert Resname Controller_____

3) Time of LS test_____Line_____Telco Line Number_____

2,4) Controller Names	VTAM Status	5,6) E/T	Additional Most Recent Statistical Data		
			Data Rate	7) Local HIT LQ CDLST RINT	Remote HIT LQ CDLST RINT 15 MIN

Remember: This data describes the network only at the instant of the alert.

CHAPTER 5: THE FLOW CHARTS

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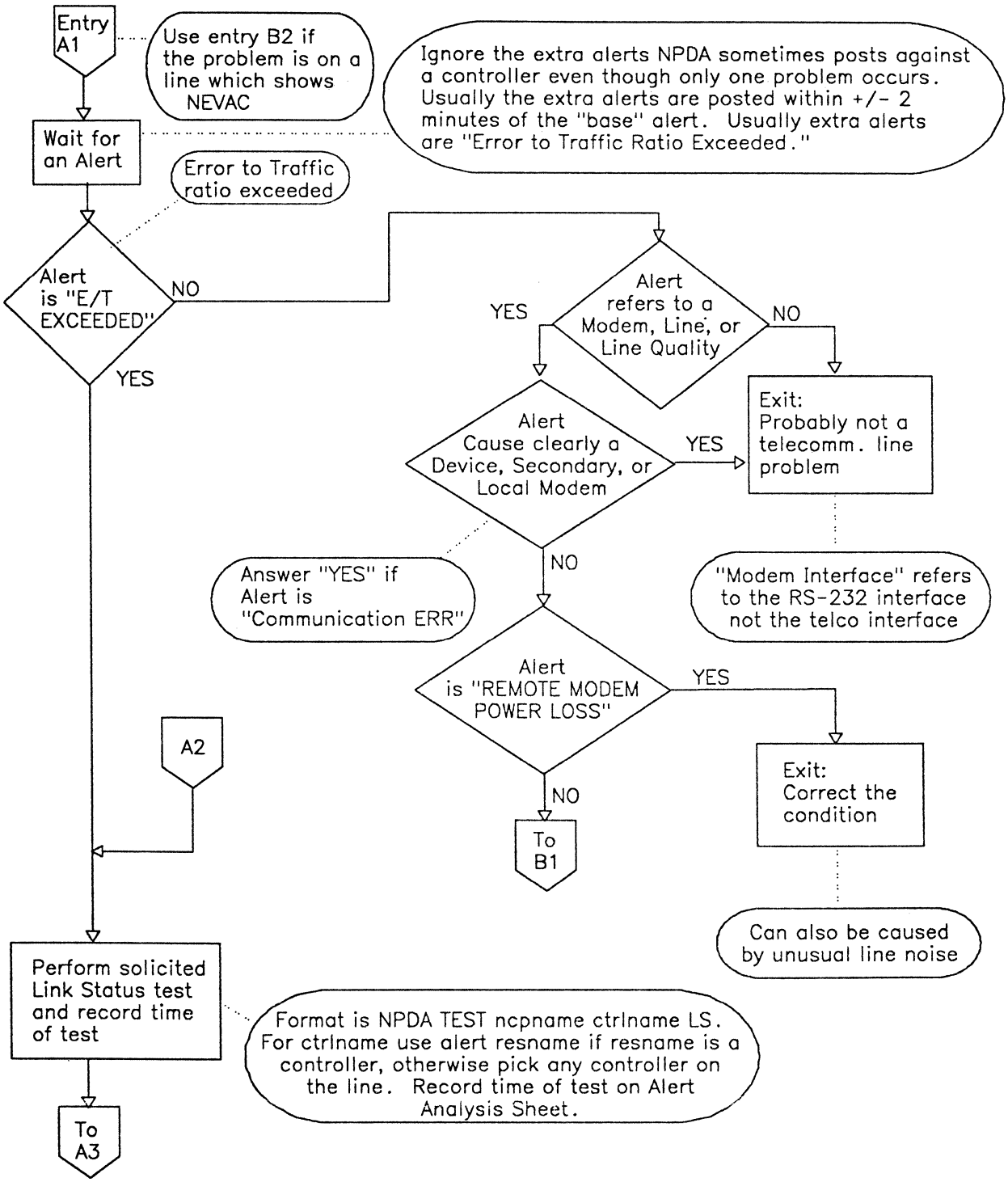


Figure 4. Chart A - Alert and LS Test Screening

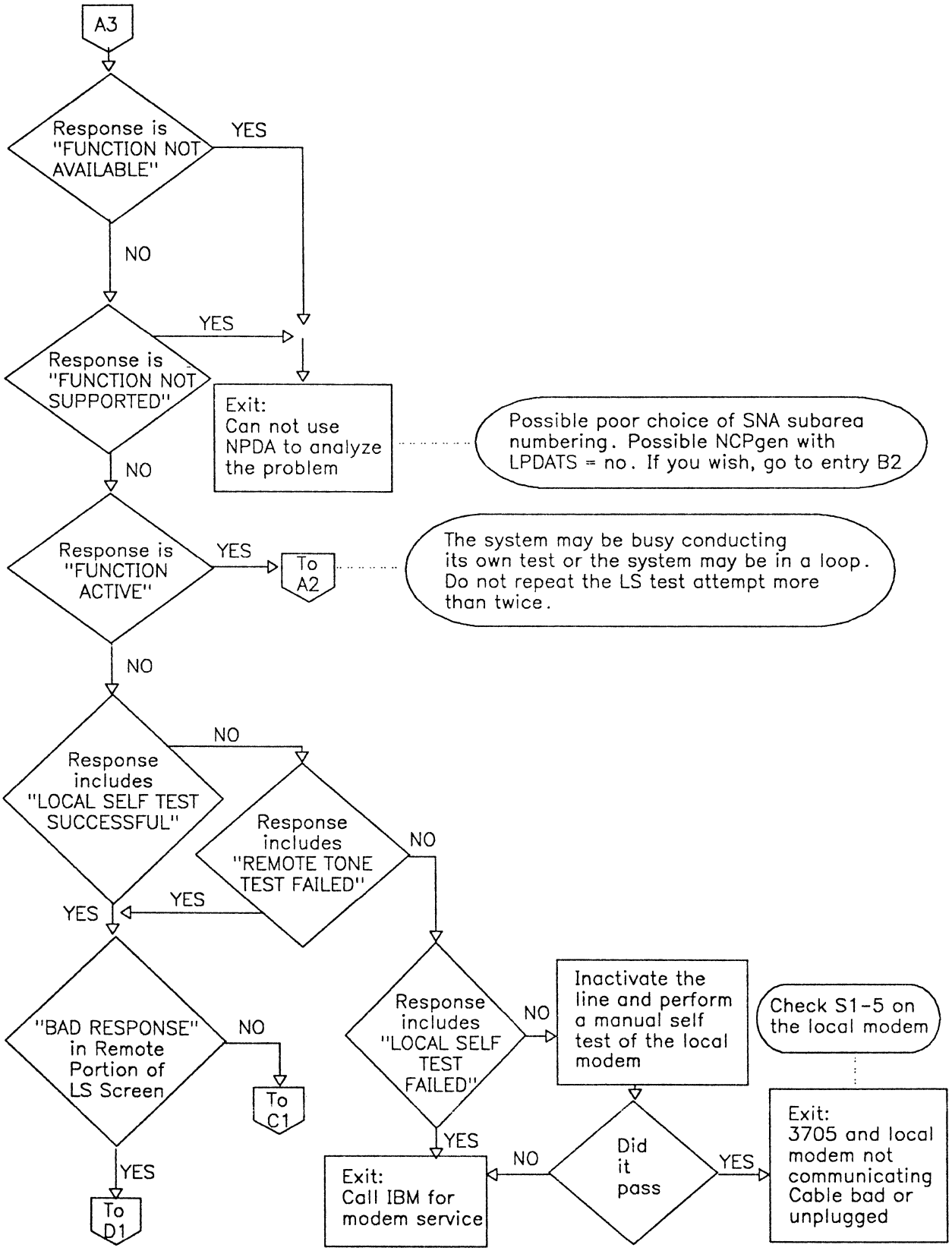


Figure 5. Chart A - Alert and LS Test Screening (continued)

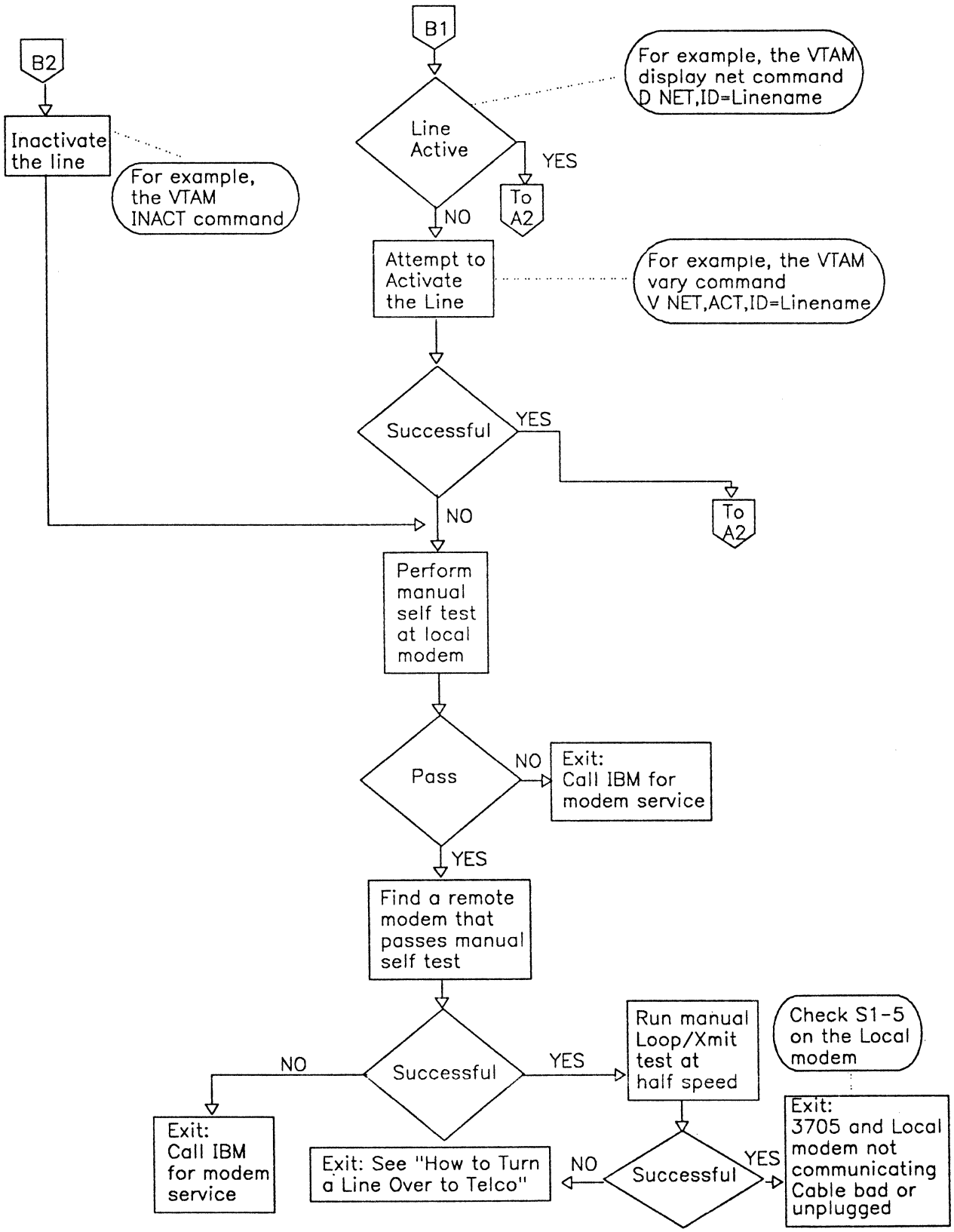


Figure 6. Chart B - NPDA Usability Screening

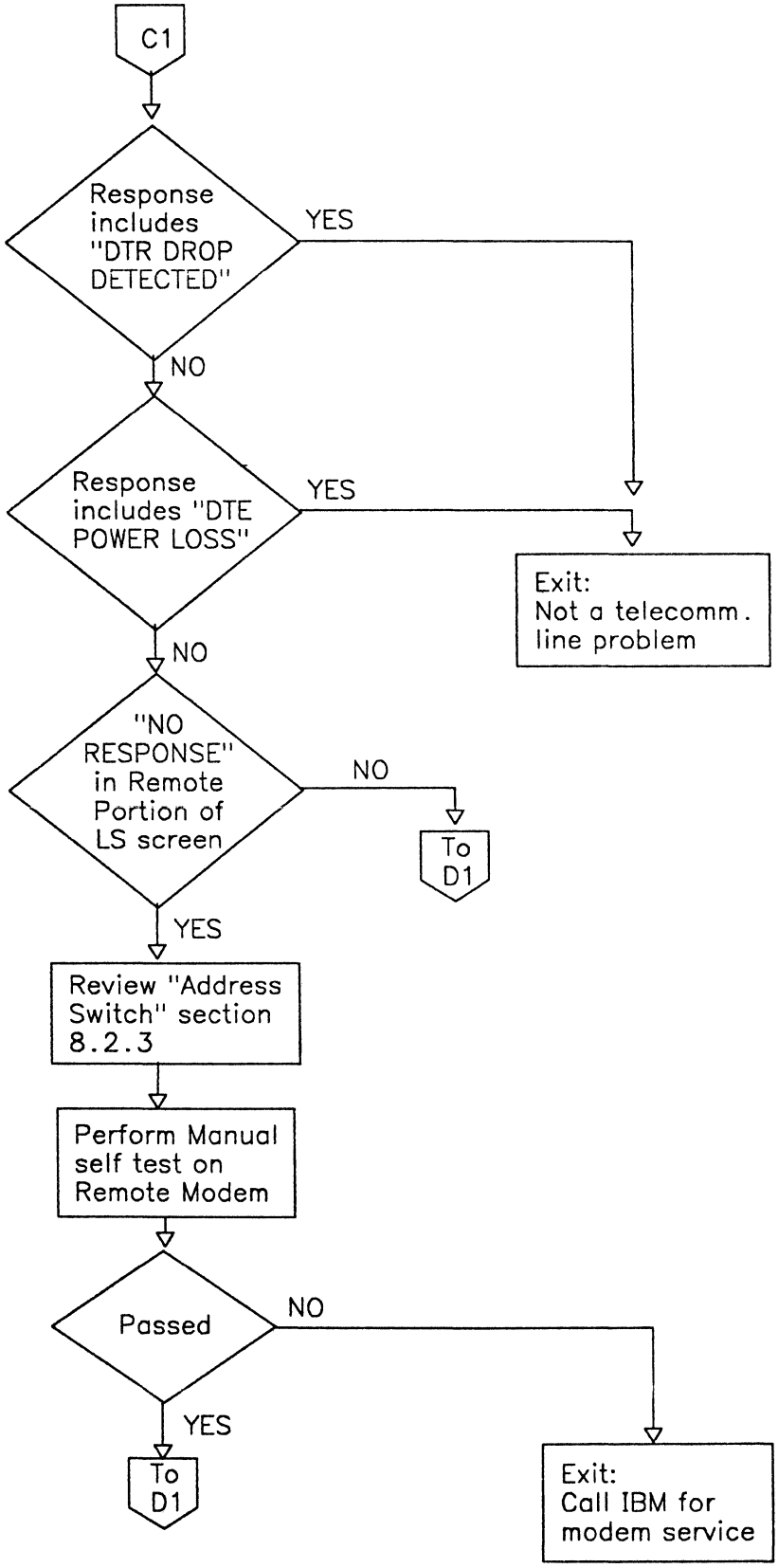
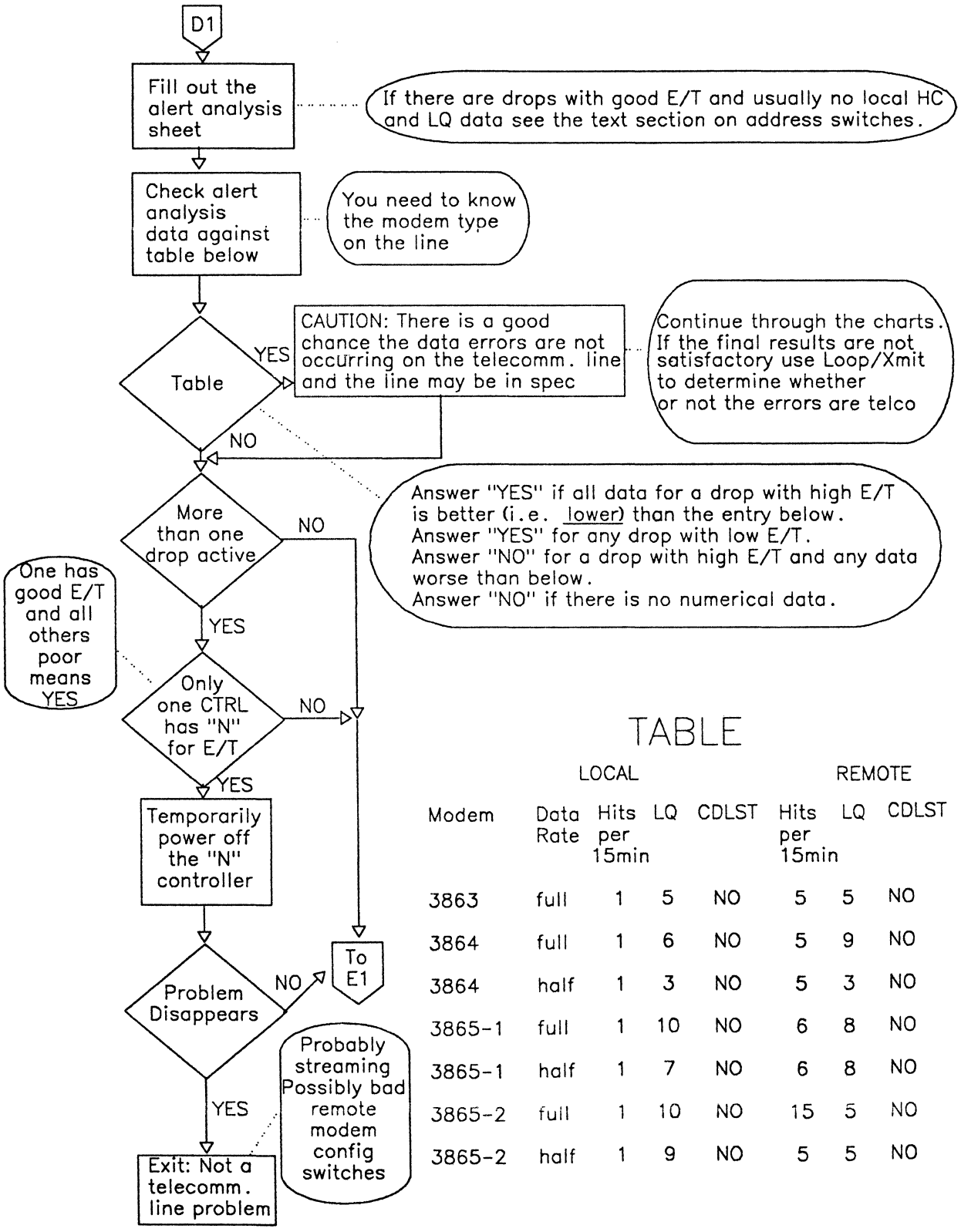


Figure 7. Chart C - LS Test Final Screening



TABLE

Modem	Data Rate	LOCAL Hits per 15min	LOCAL LQ	LOCAL CDLST	REMOTE Hits per 15min	REMOTE LQ	REMOTE CDLST
3863	full	1	5	NO	5	5	NO
3864	full	1	6	NO	5	9	NO
3864	half	1	3	NO	5	3	NO
3865-1	full	1	10	NO	6	8	NO
3865-1	half	1	7	NO	6	8	NO
3865-2	full	1	10	NO	15	5	NO
3865-2	half	1	9	NO	5	5	NO

Figure 8. Chart D - Streaming and Initial Line Screening

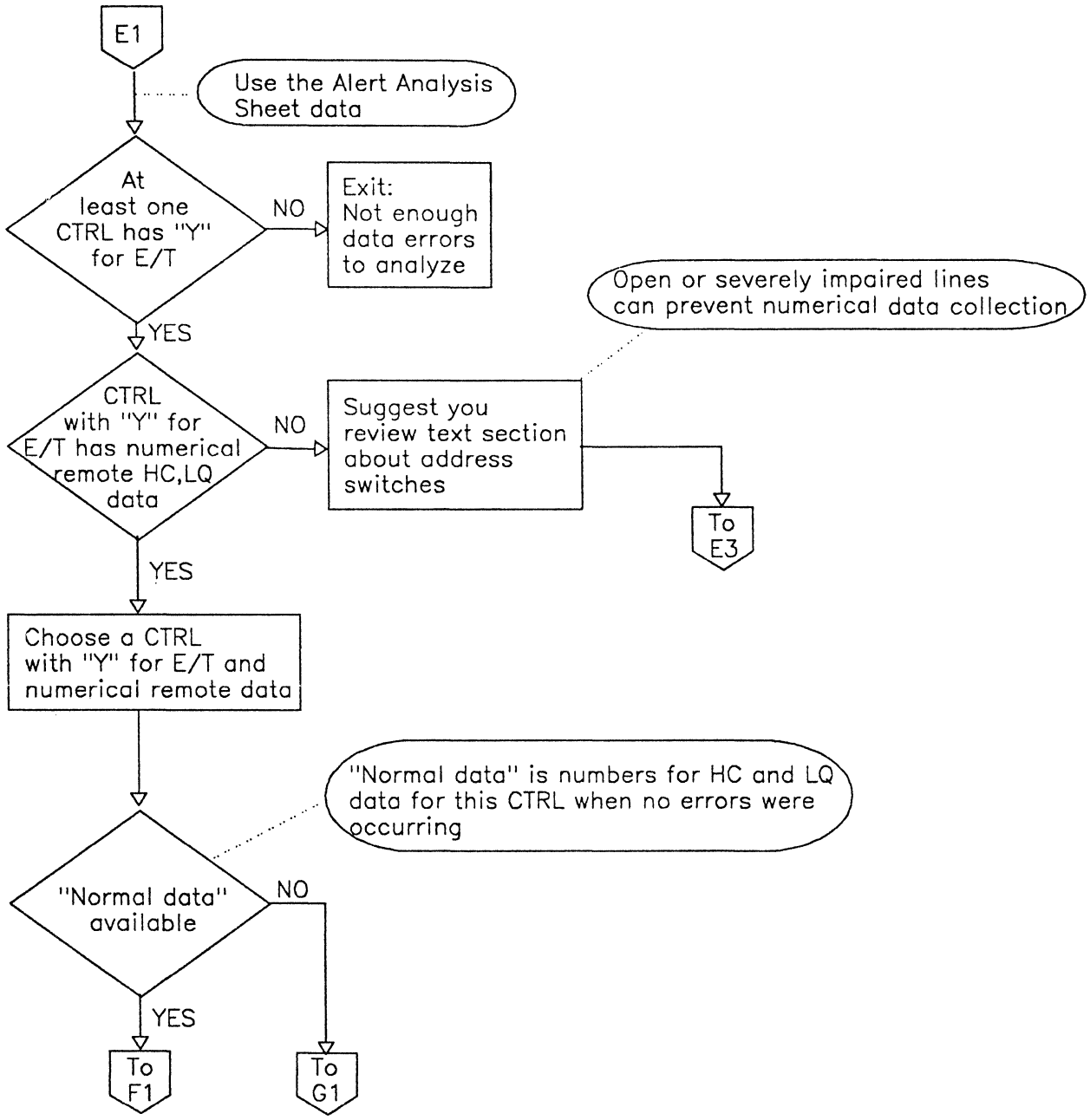


Figure 9. Chart E - Open Line and Initial Line Side

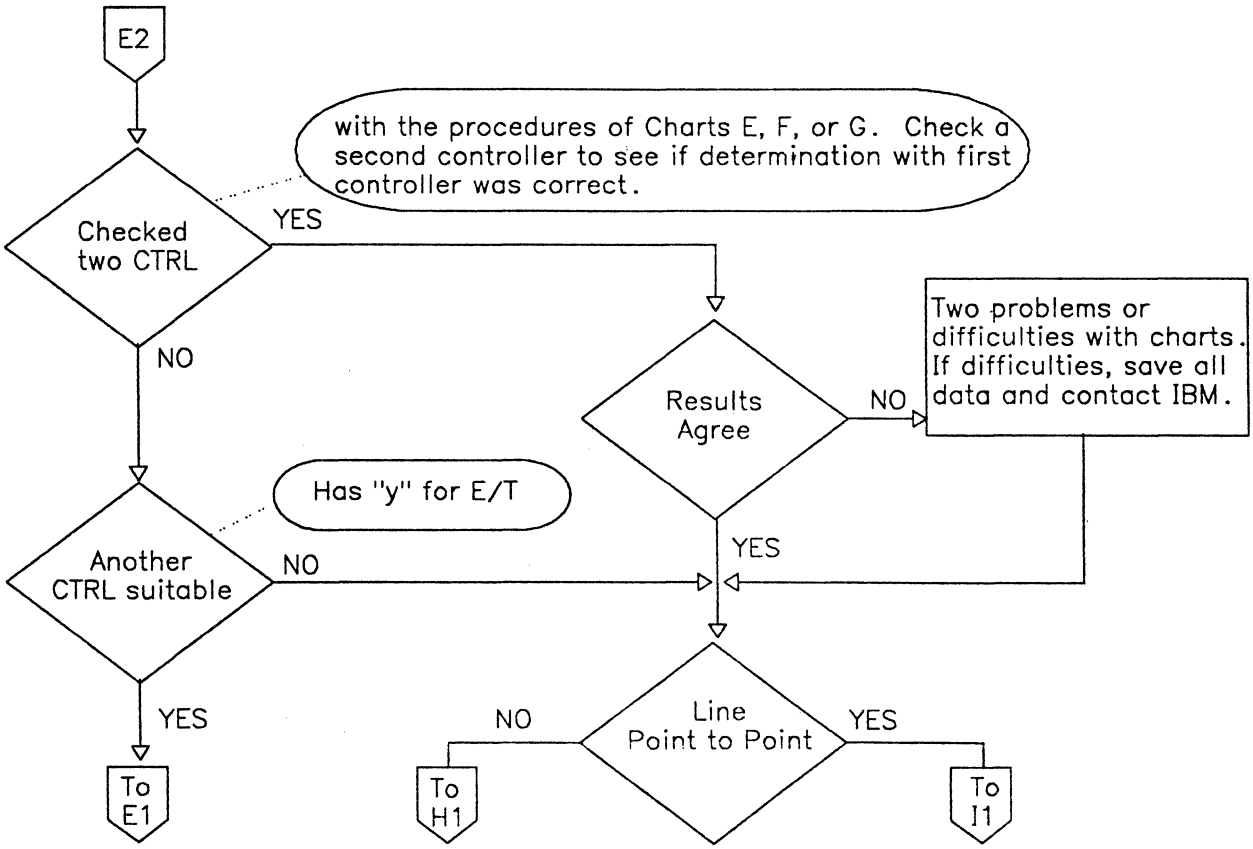


Figure 10. Chart E - Open Line and Initial Line Side (continued)

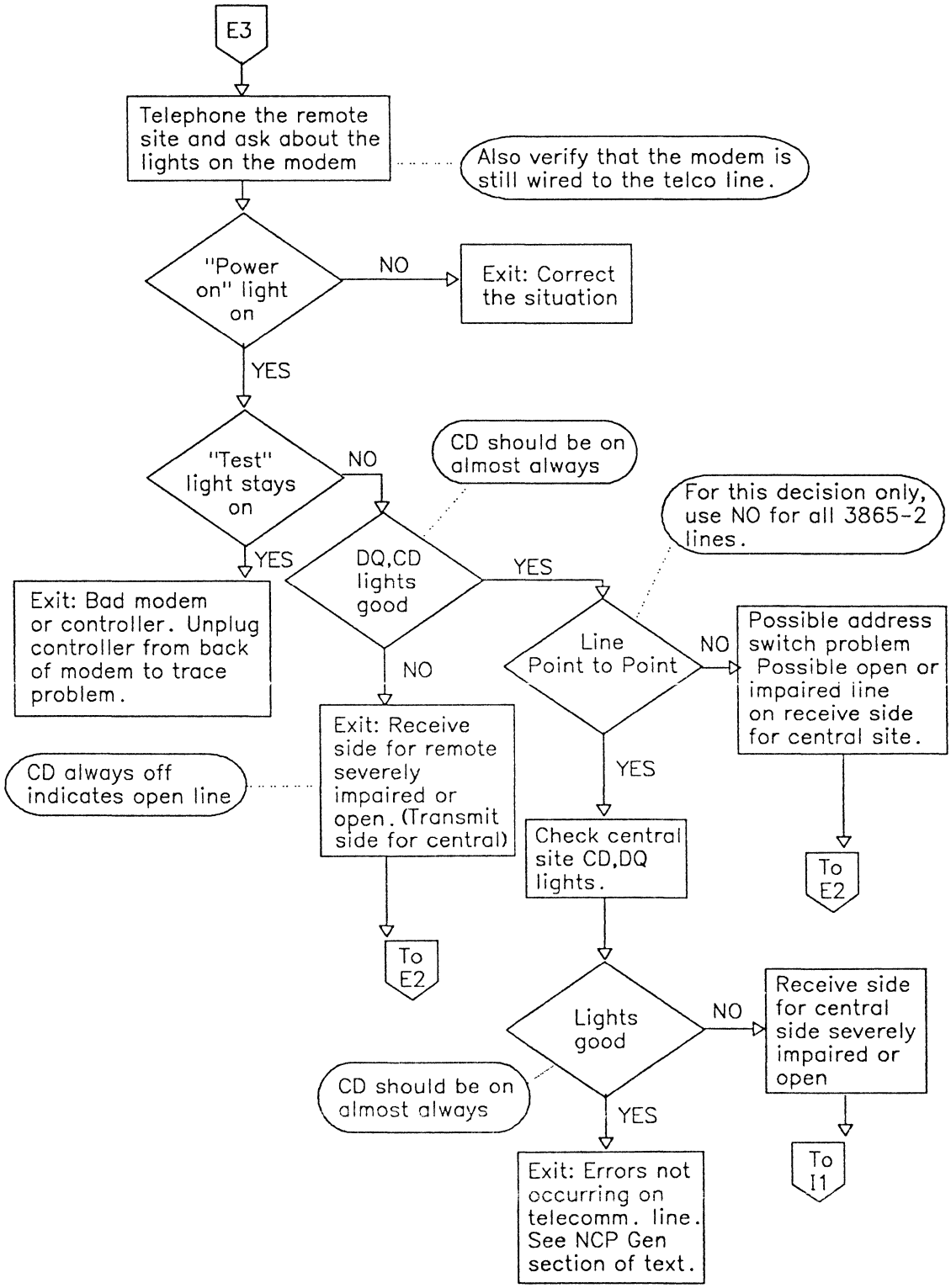


Figure 11. Chart E - Open Line and Initial Line Side (continued)

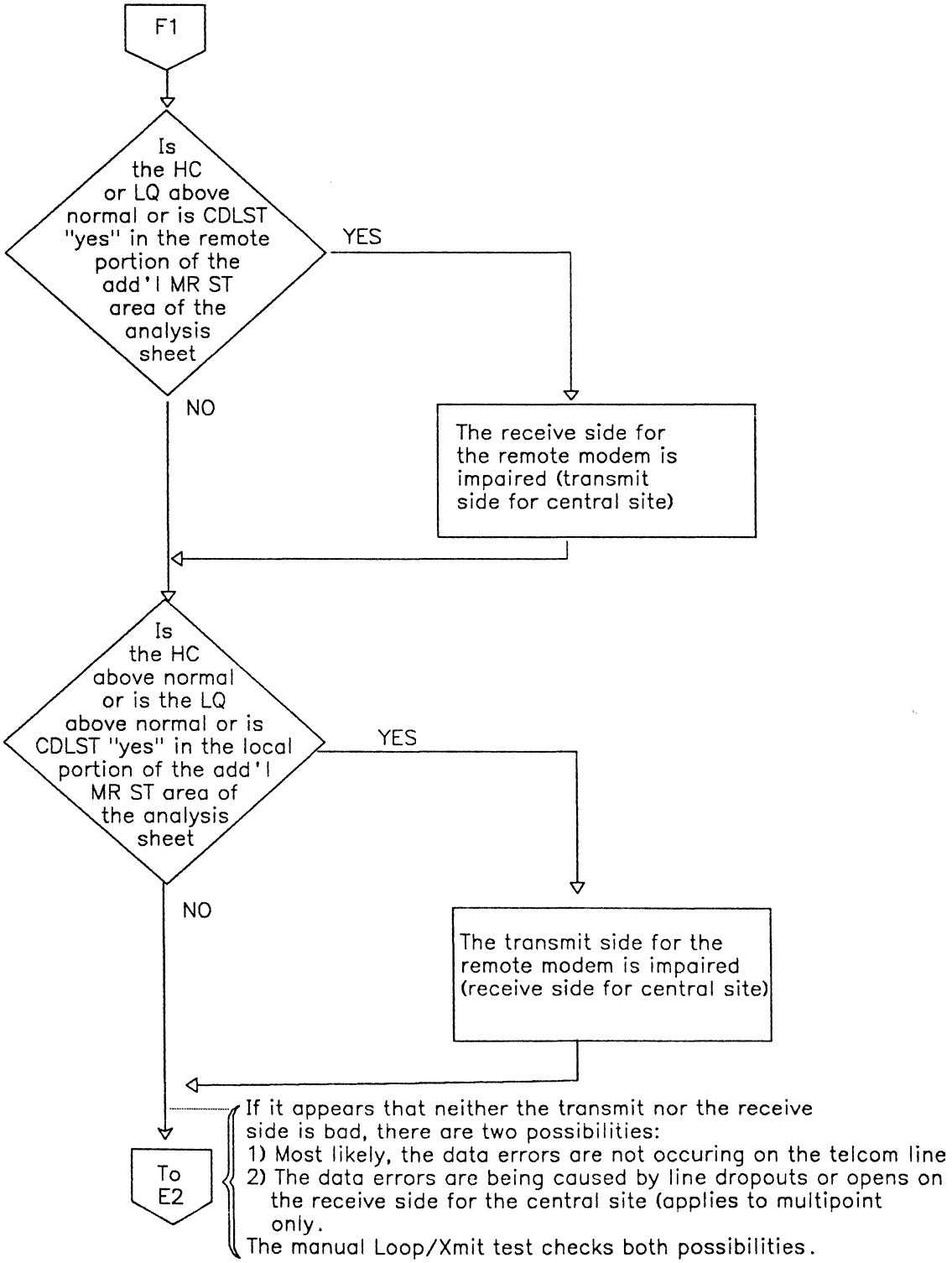


Figure 12. Chart F - Line Direction/Side with "Normal" Data

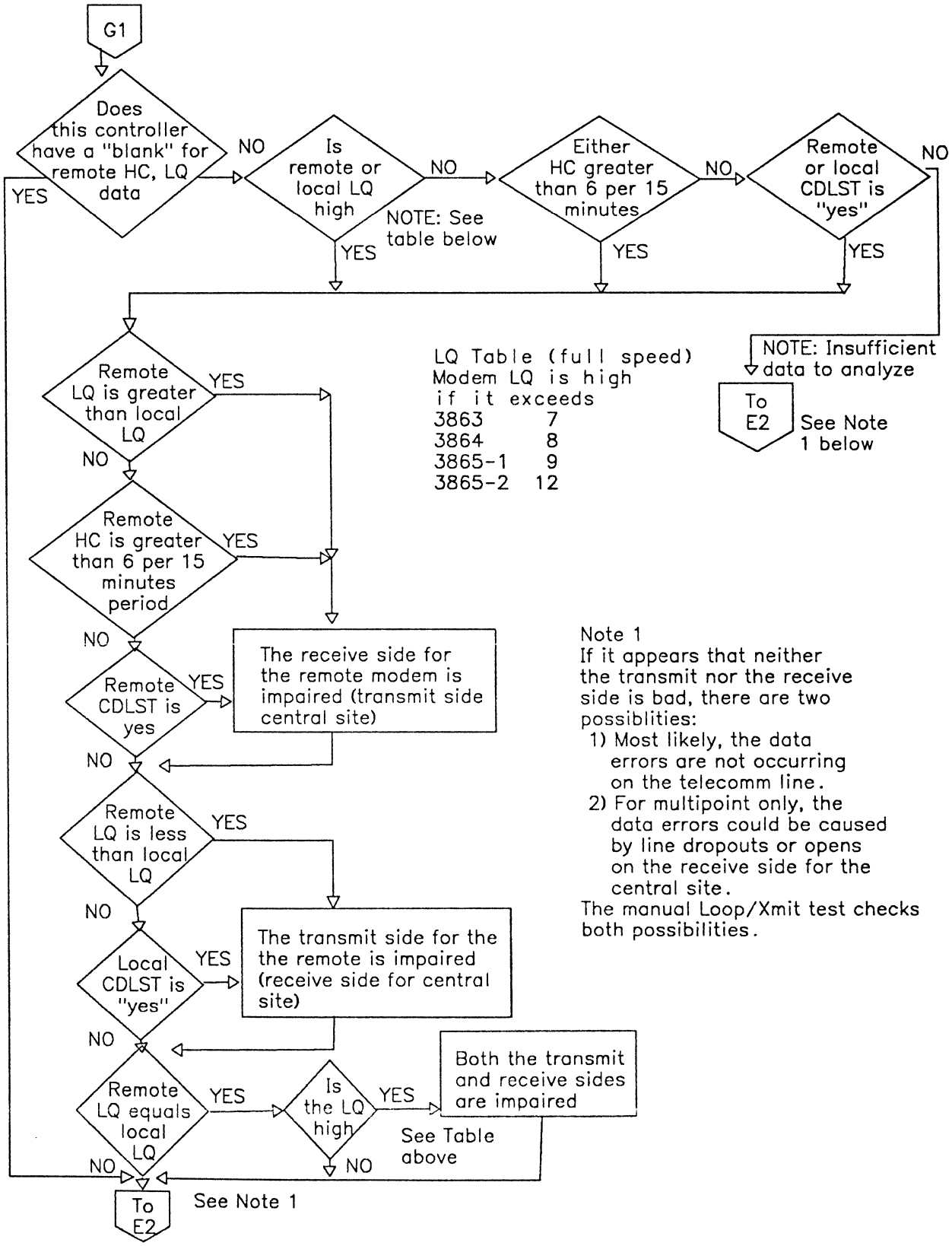


Figure 13. Chart G - Line Direction/Side without "Normal" Data

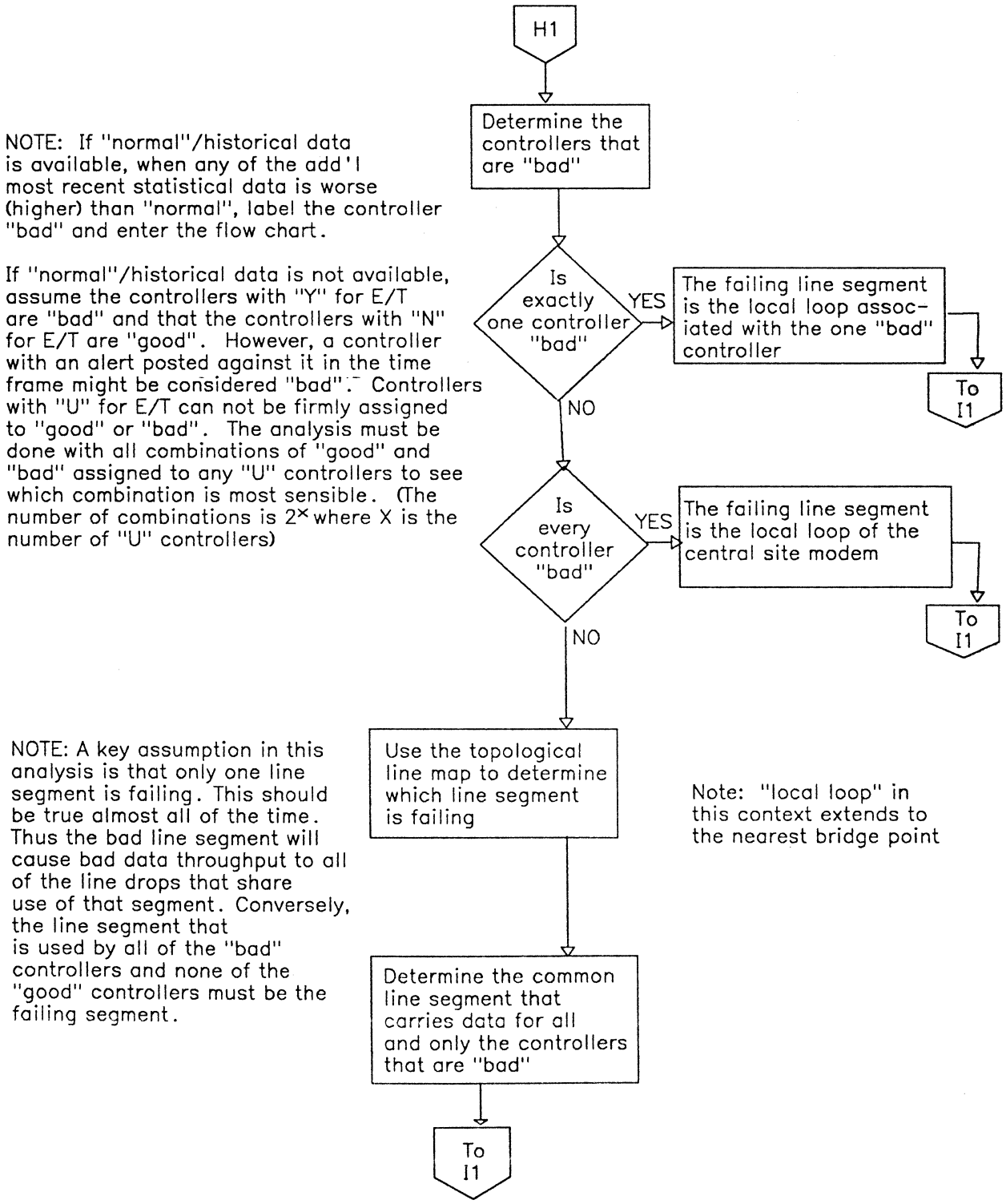


Figure 14. Chart H - Line Segment/Leg

Notes:
1. Use full speed figures for Hit count (HC), Line Quality (LQ) and Carrier Detect Loss (CD Loss) except where noted

2. Use data from the alert analysis sheet

3. For maximum diagnostic information run modems at both speeds (full and half). This is critical for 3865 modems

4. "Impairment is on local side" is equivalent to saying that the receive side for the central site is impaired

5. If you use half speed operation for diagnostic purposes and not throughout, set the local modem back to full speed at the end of the analysis

Caution:
The analog line impairment flow charts which follow assume the line is impaired. If Chart D indicated the line may be in spec or if Charts F and G could not identify which side of the line is impaired, be cautious.

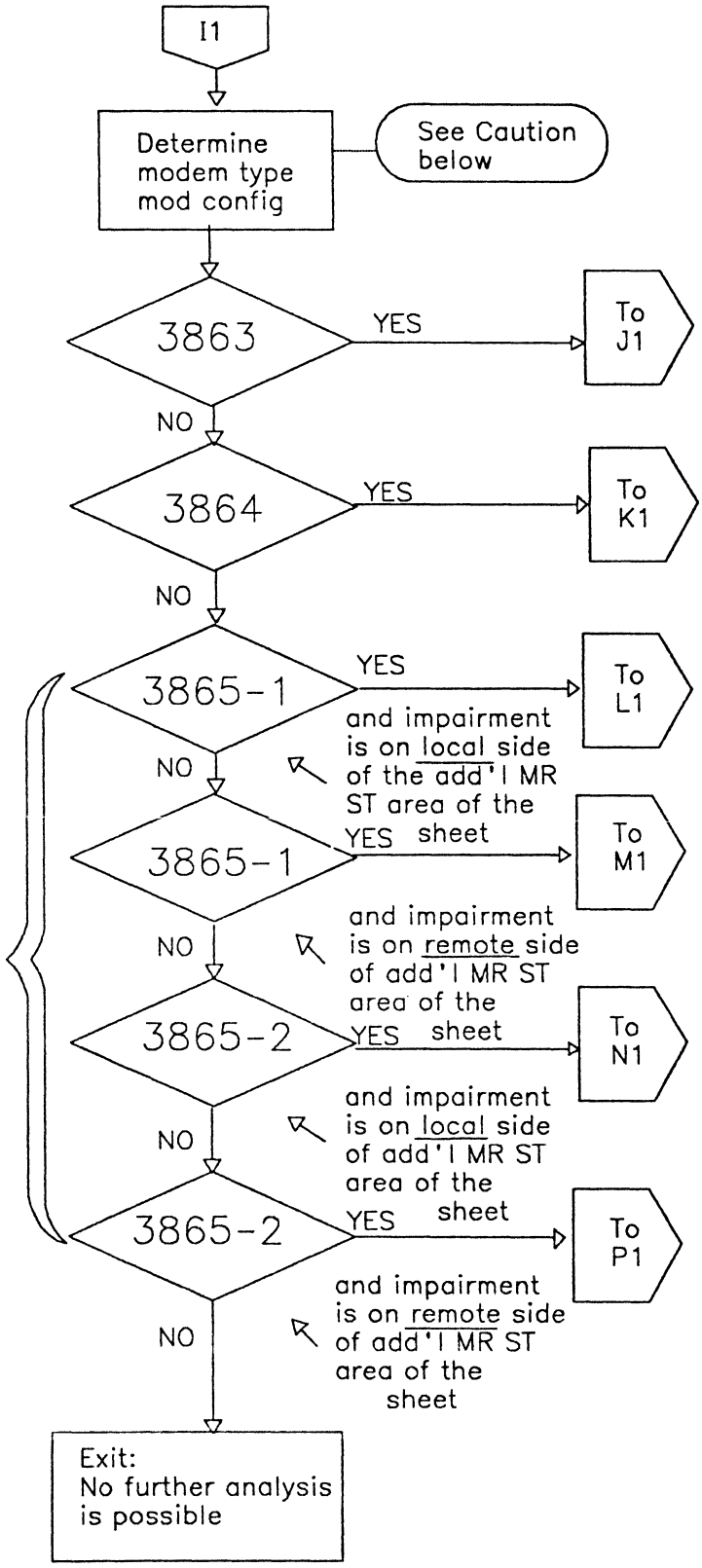


Figure 15. Chart I - Analog Line Impairment

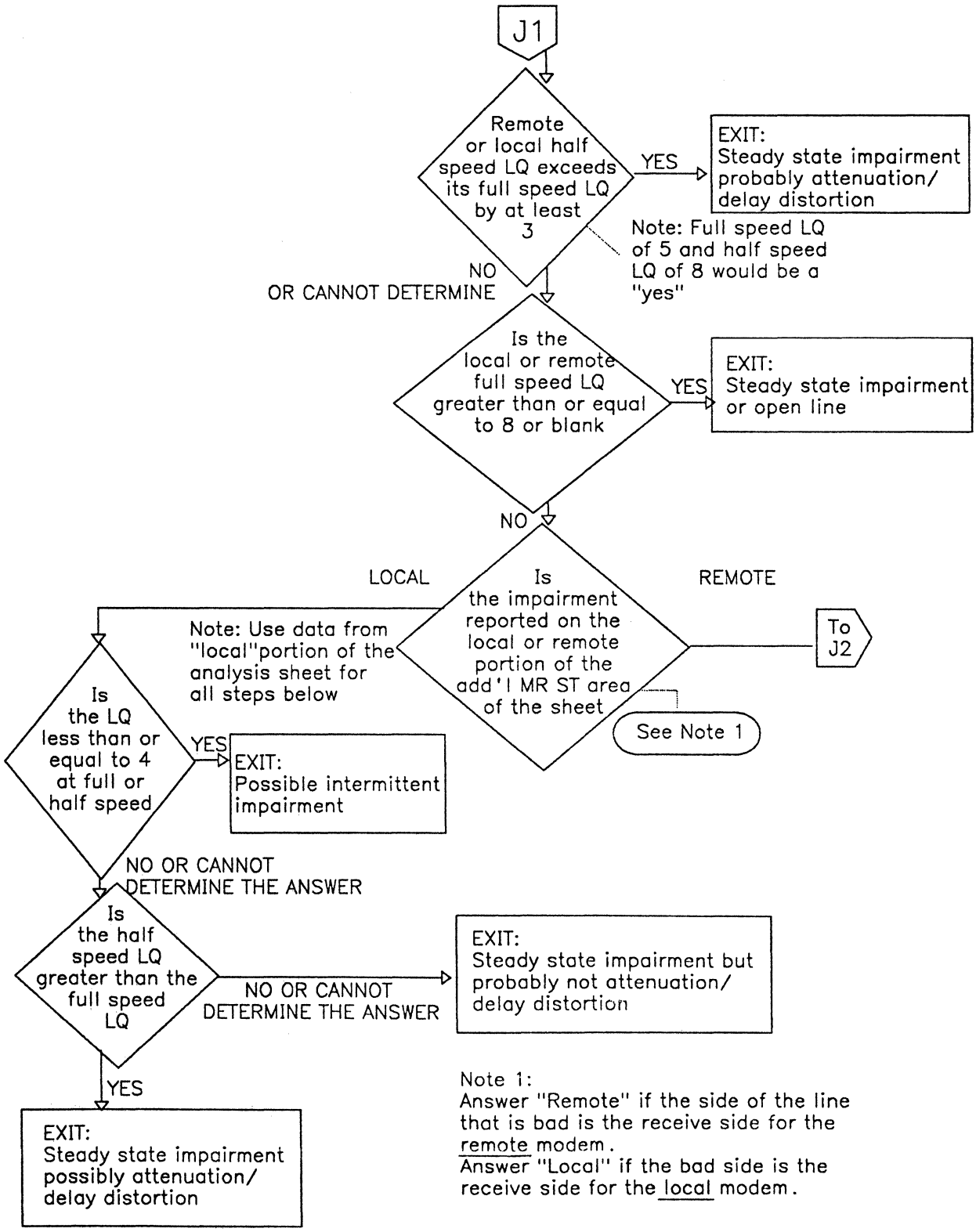


Figure 16. Chart J - 3863 Analog Line Impairment

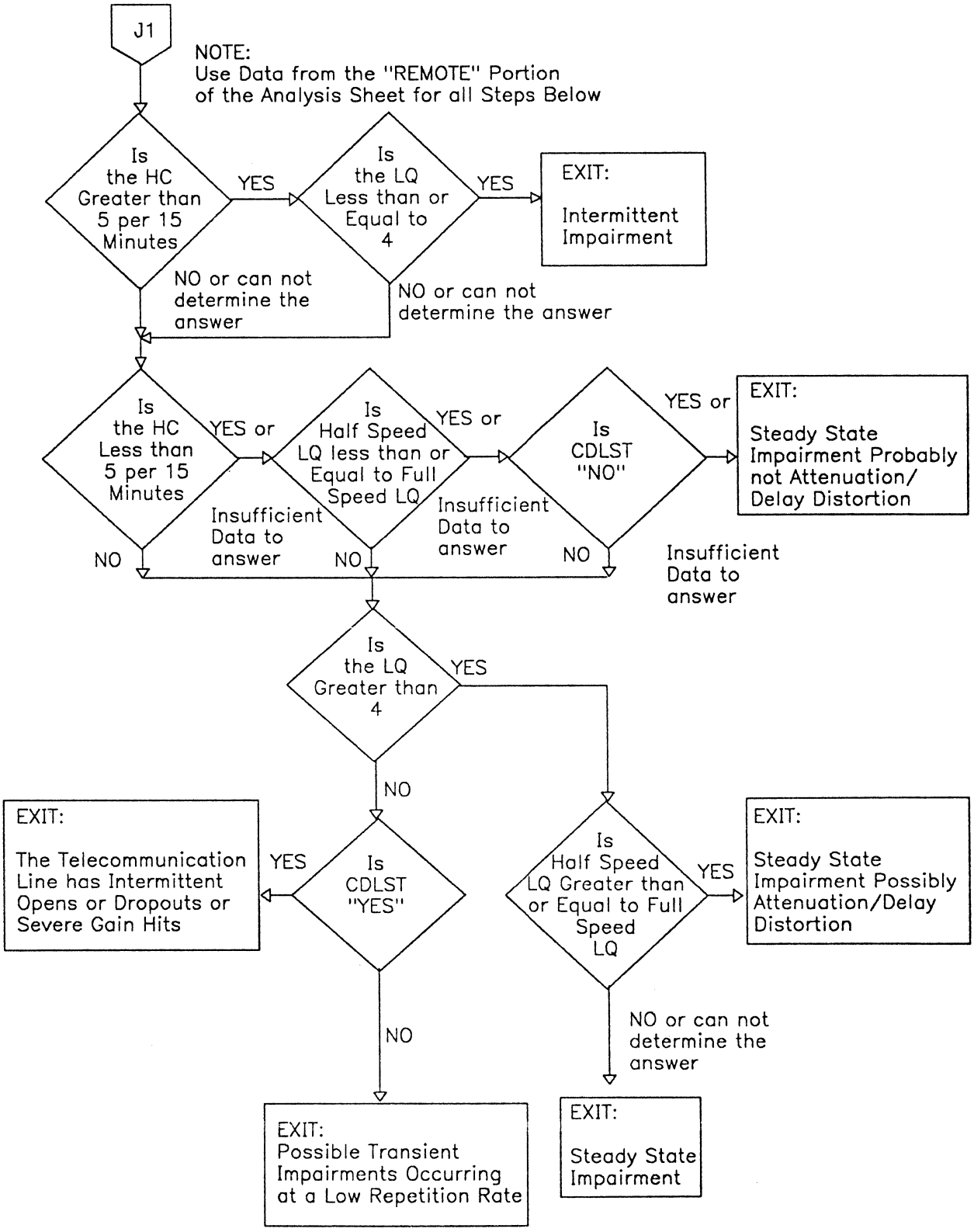


Figure 17. Chart J - 3863 Analog Line Impairment (continued)

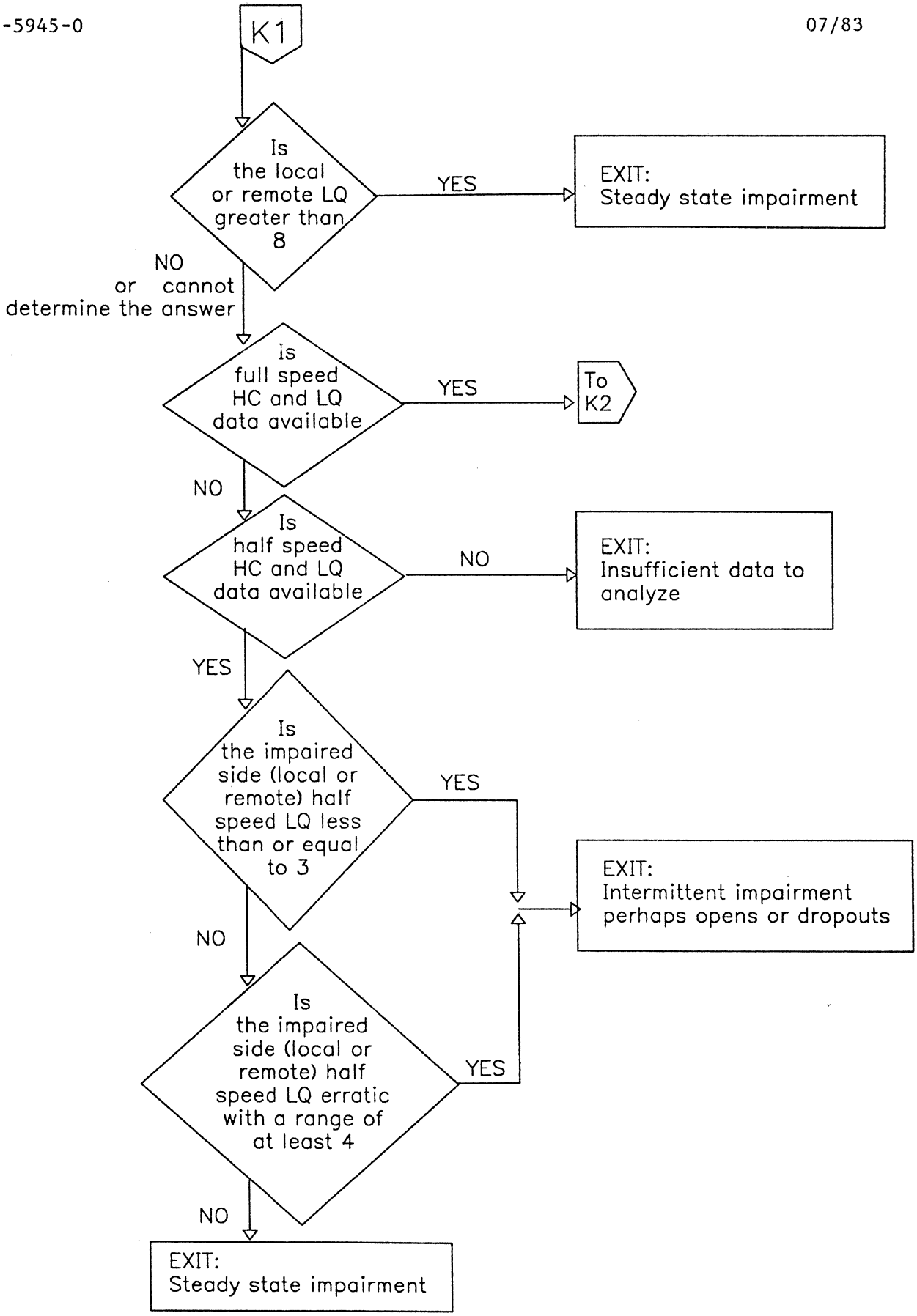


Figure 18. Chart K - 3864 Analog Line Impairment

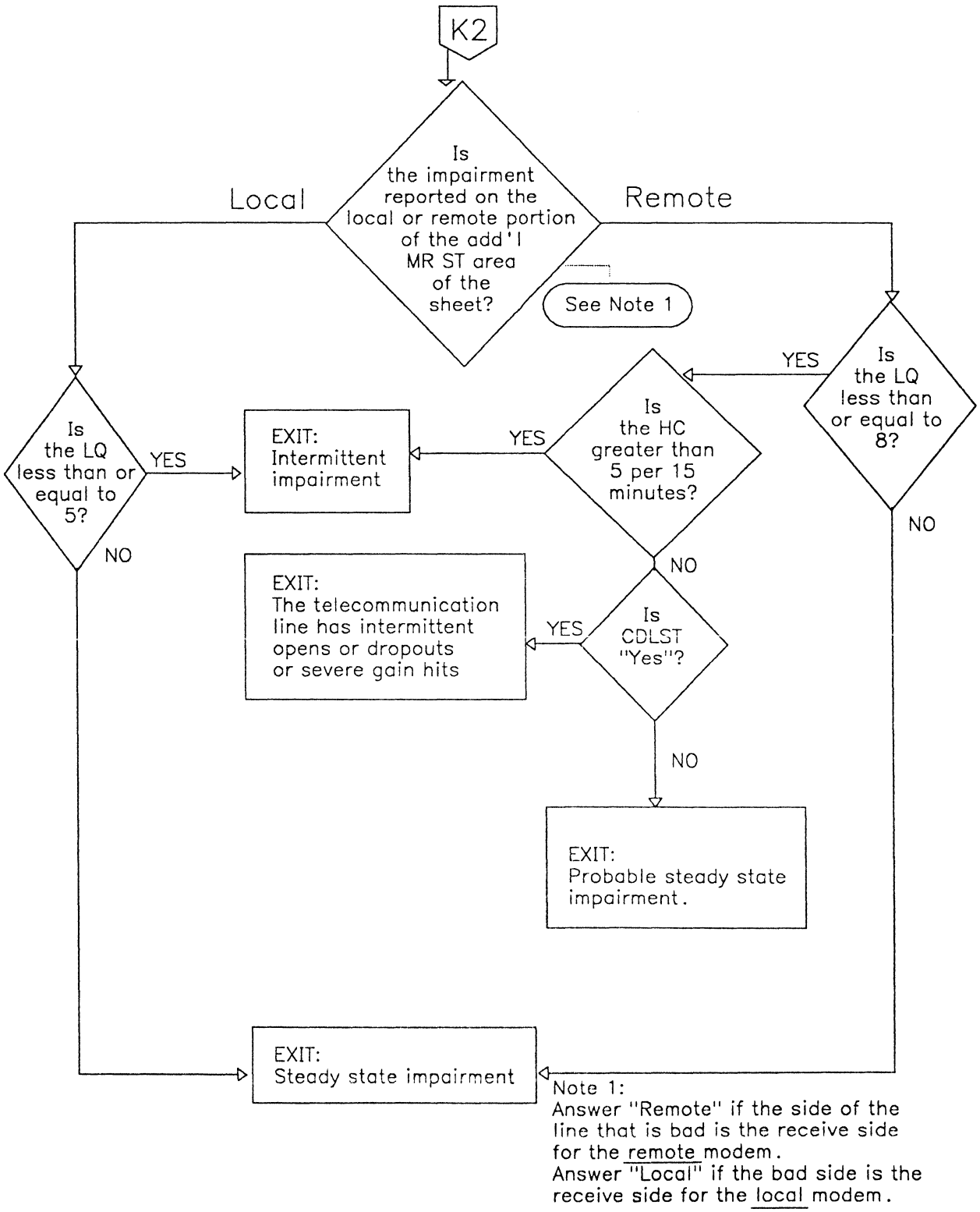


Figure 19. Chart K - 3864 Analog Line Impairment (continued)

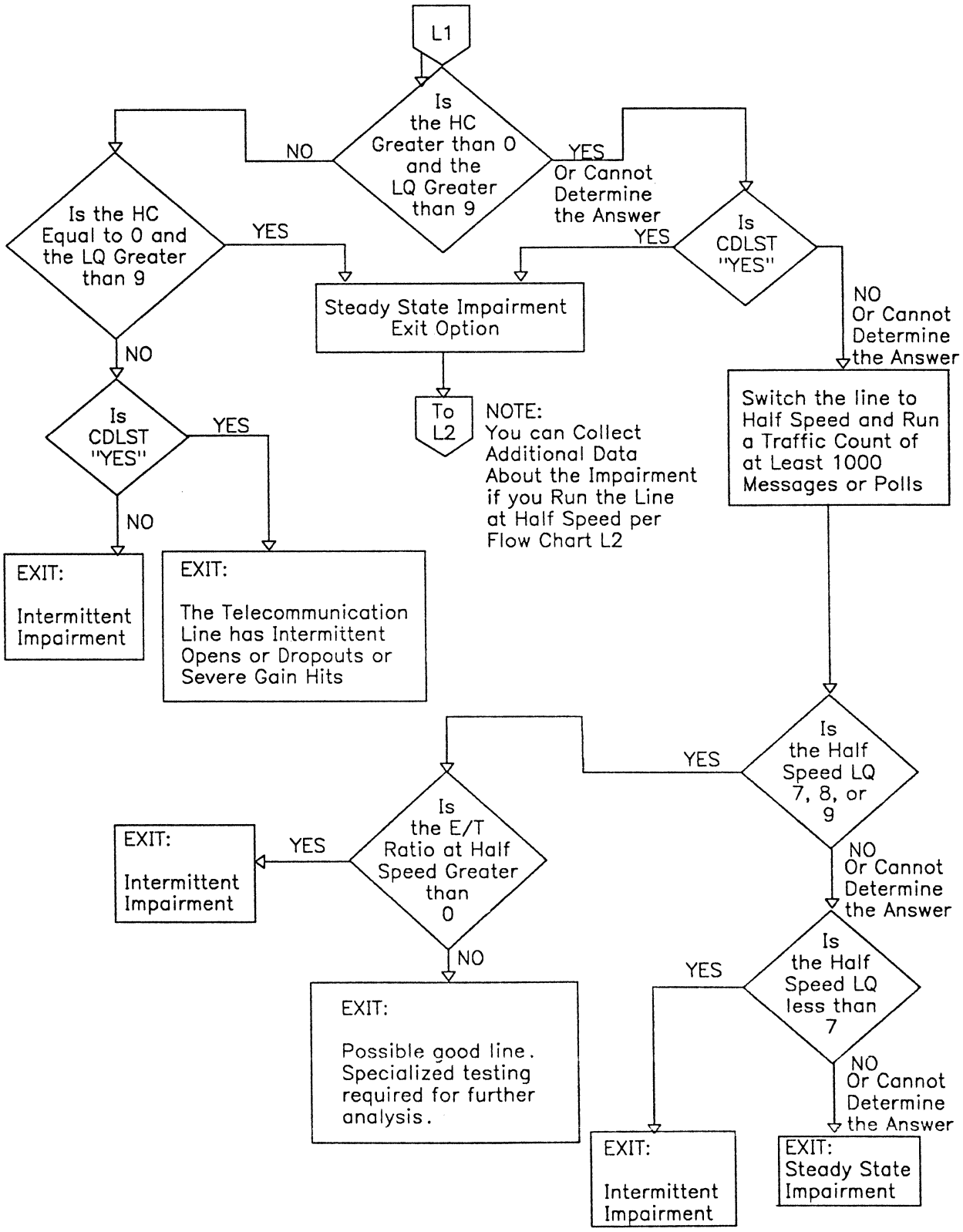


Figure 20. Chart L - 3865-1 "Local" Line Impairment

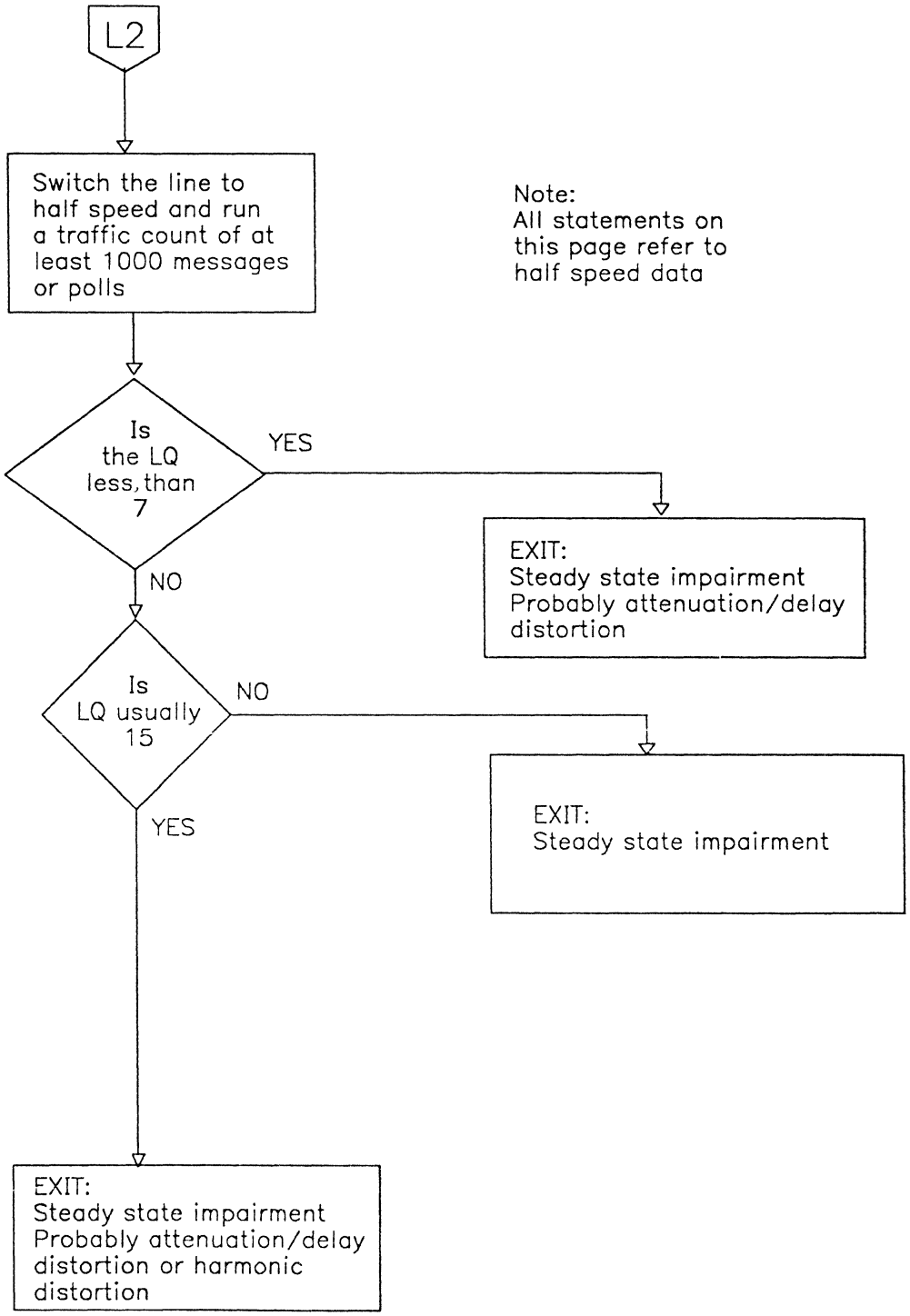


Figure 21. Chart L - 3865-1 "Local" Line Impairment (continued)

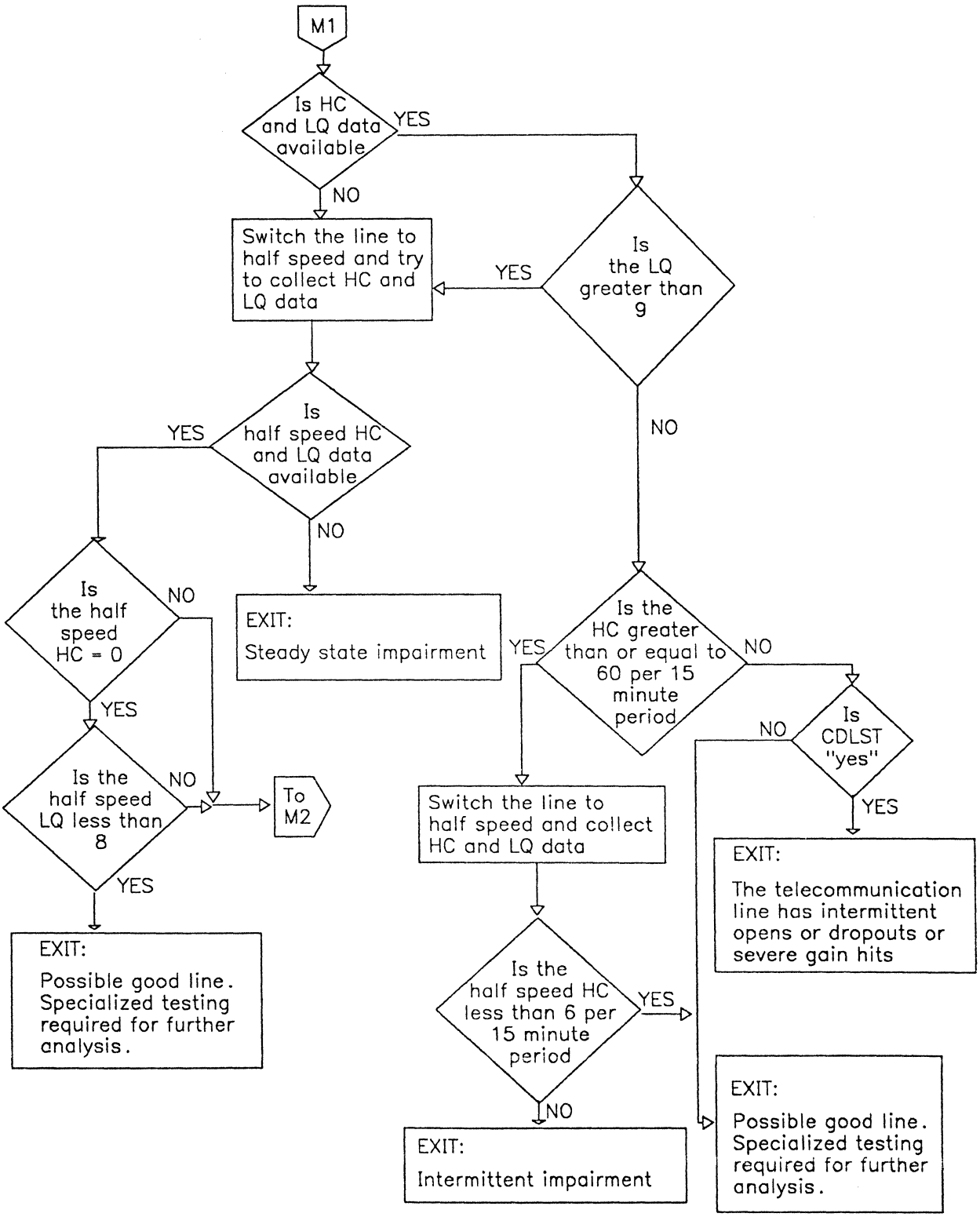


Figure 22. Chart M - 3865-1 "Remote" Line Impairment

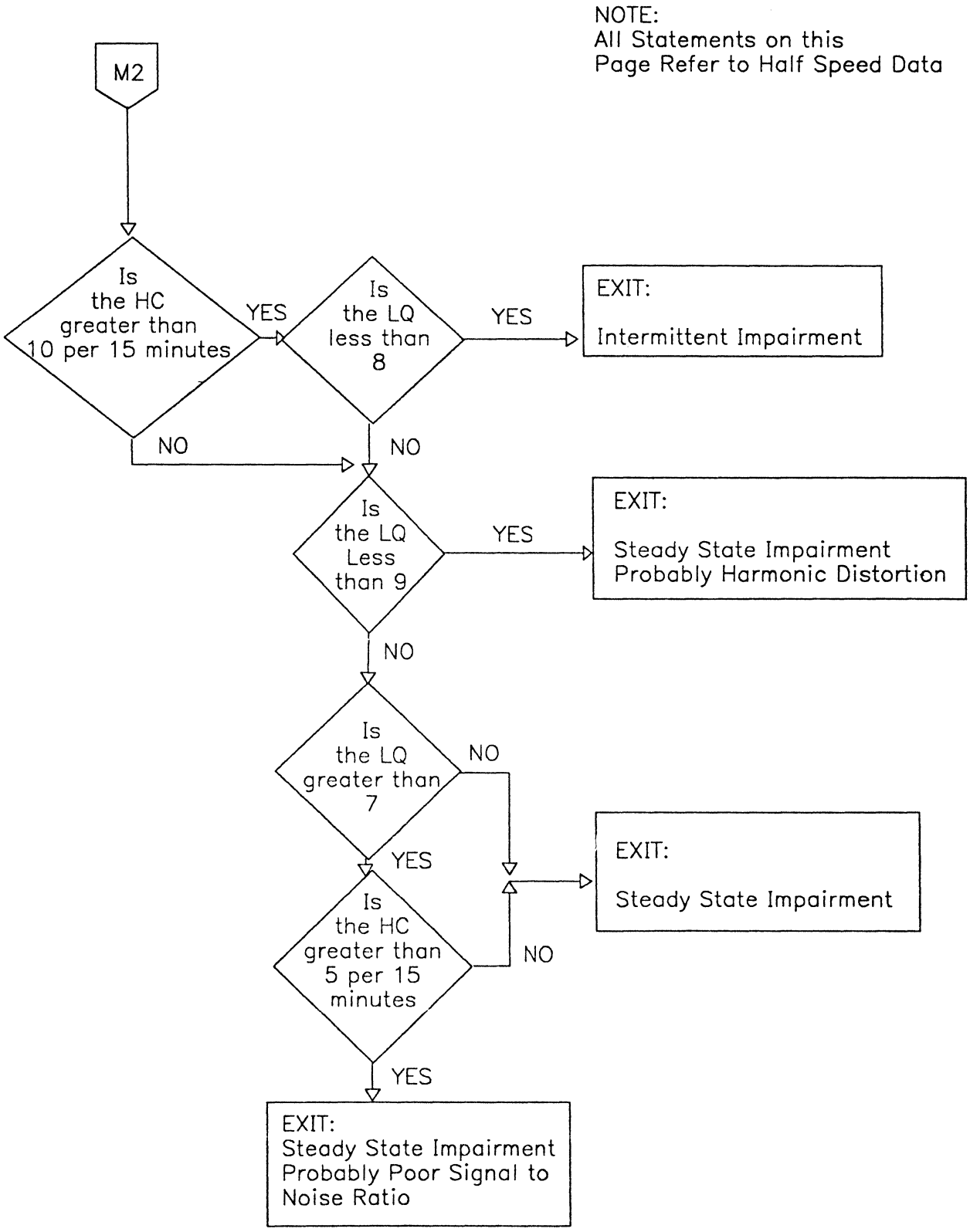


Figure 23. Chart M - 3865-1 "Remote" Line Impairment (Continued)

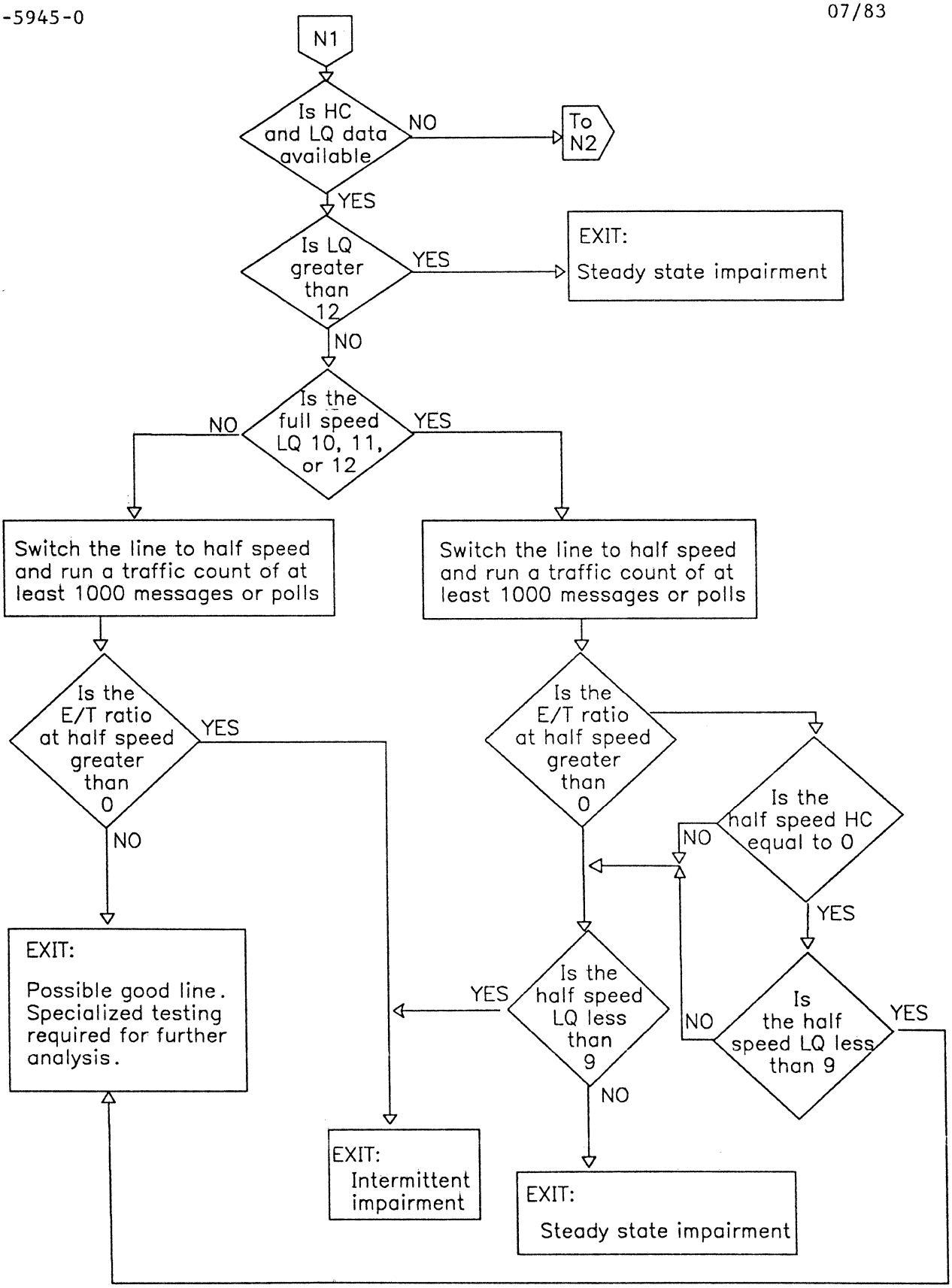


Figure 24. Chart N - 3865-2 "Local" Line Impairment

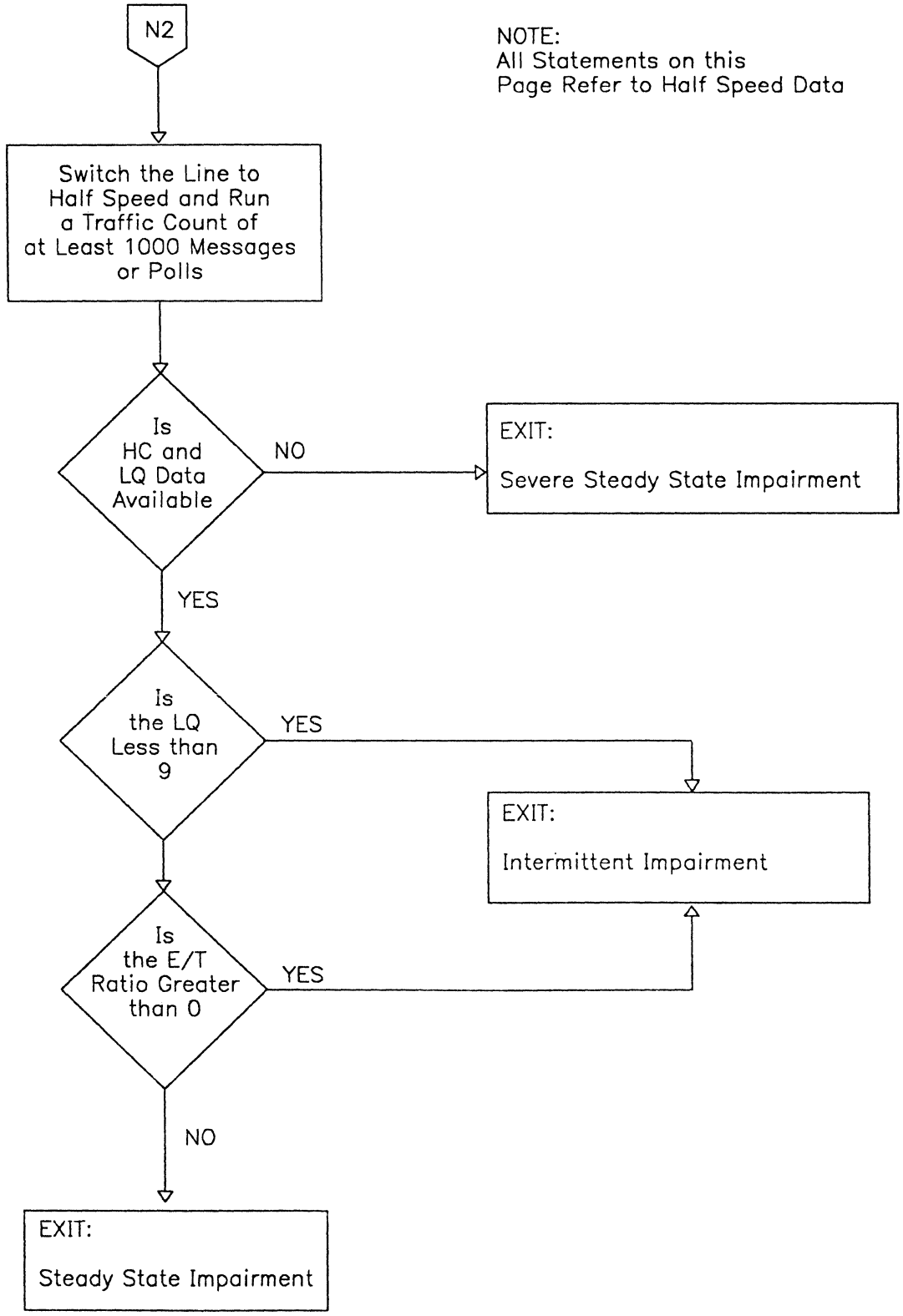


Figure 25. Chart N - 3865-2 "Local" Line Impairment (continued)

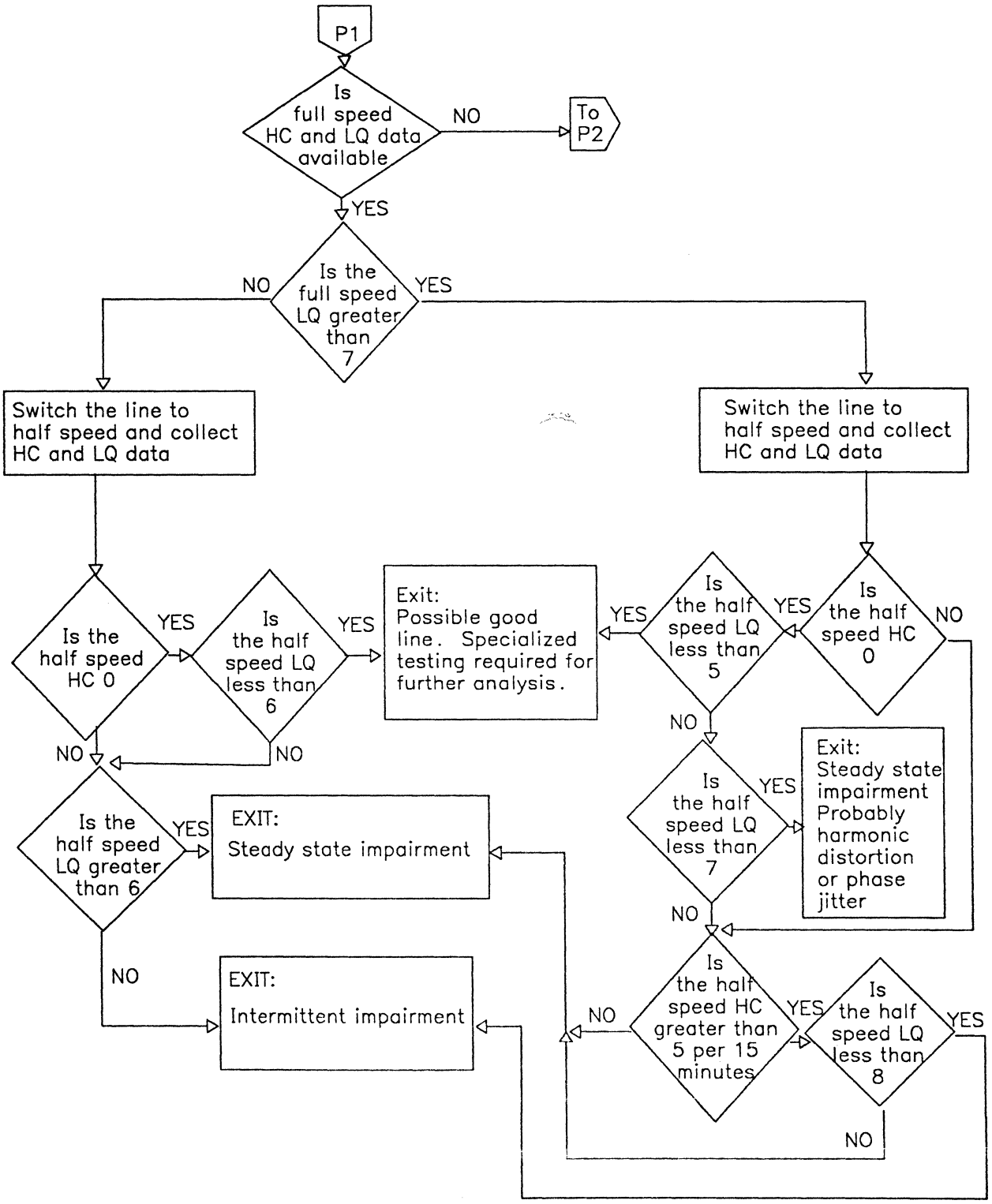


Figure 26. Chart P - 3865-2 "Remote" Line Impairment

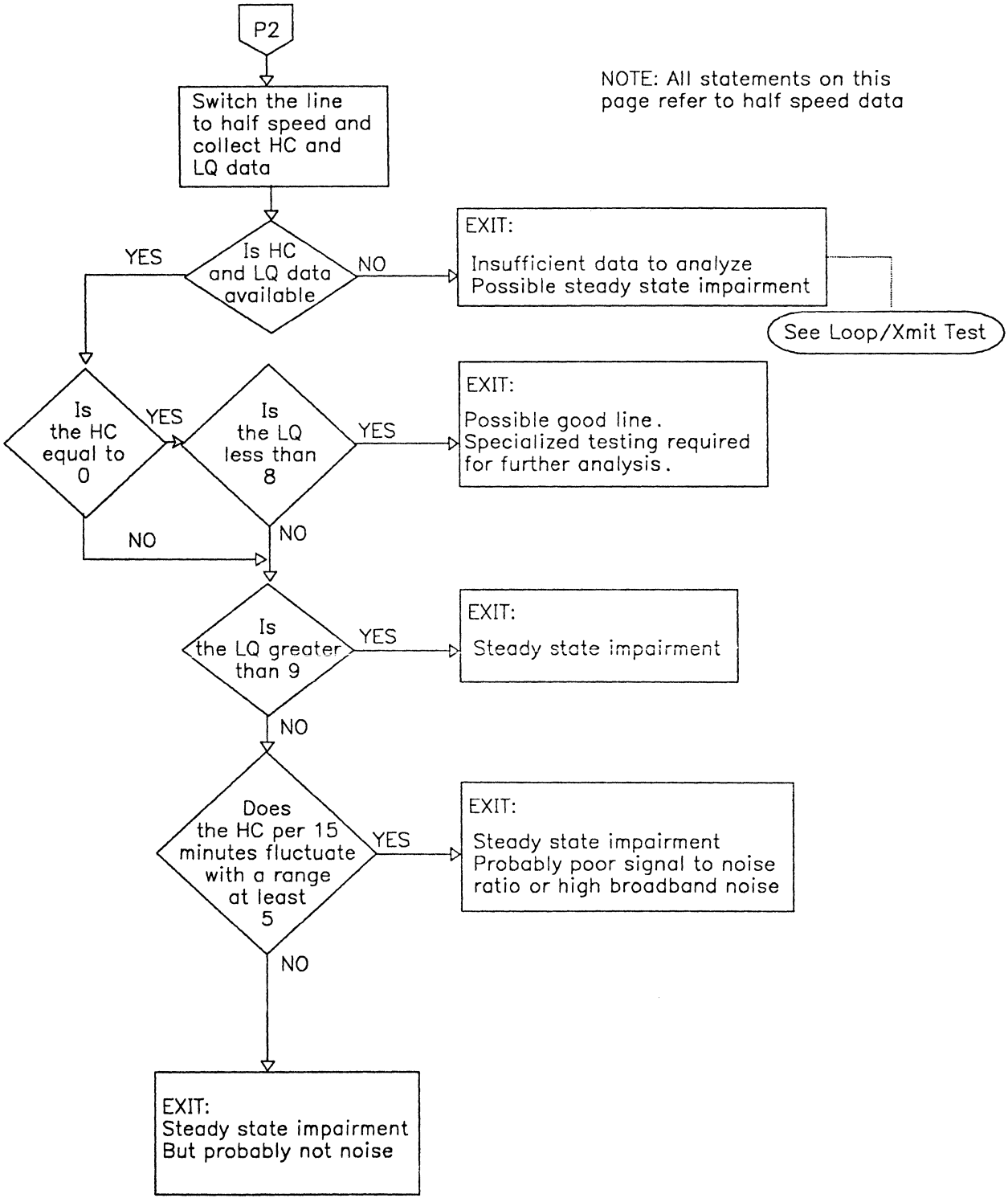


Figure 27. Chart P - 3865-2 "Remote" Line Impairment (continued)

TROUBLE REPORTING TO TELECOMMUNICATION VENDORS

The person reporting problems to the communication vendor should report the location of the trouble. For example, the trouble is on circuit number XXXX, and the problem is a high number of errors when receiving from station located in city XYZ. (This specifies wire pair with problem.) The time of day of occurrence of the problem is also important.

If it is a multipoint network you should also tell the communication vendor if this location is the only station failing on the multipoint circuit. If the problem is determined to be an open line then line open, circuit direction, location, and time of day is about the extent of information that should be required to define the problem to the communication vendor for prompt repair.

To work with NPDA and the procedures here specified for problem determination and isolation on telephone lines the user should have a current network chart circuit by circuit including bridge points. This chart is required along with the flow charts to isolate the network segment for adequate trouble reporting.

If the problem is other than an open line there is additional information (other than wire pair and segment) which can be given by using NPDA V2 screens

1. Most Recent Statistical Data
2. Additional Most Recent Statistical Data.

and translating the screen data into telecommunication jargon using the flow charts.

When the flow charts point to an analog parameter or class of parameters the information can help the telecommunication vendor select what tests to use in his efforts to verify the existence of the problem. The normal quick check which vendors use tests only the steady state line impairments such as phase jitter, broad-band noise, harmonic distortion, etc. This testing takes very little time which is advantageous because it minimizes line down time for testing. Unfortunately, the class of impairments labeled here as "Intermittent" impairments must be measured using tests that typically last 15 minutes. These intermittent impairments include impulse noise and the various type of "hits". See "Appendix B: Line Parameters and Their Effect" on page 61.

If the flow charts suggest the line impairment is intermittent, the telecommunication vendor must be told that the impairment is of the "hit" or "impulse noise" type so that the vendor uses the right type of tests to find the problem.

Note: Do not waste your time reporting Hit Count and Line Quality numbers to your telecommunication vendors. They will not understand. You can talk to them about loss of carrier.

CHAPTER 6: QUICK FIX FLOW CHARTS

DESCRIPTION AND LIMITATIONS

The quick fix flow chart should be used only after you are thoroughly familiar with the complete flow chart package otherwise the quick fix chart will not make sense. For example, the first decision block requires the user to decide if it is possible for NPDA to communicate with the central site modem. The easiest way to make such a decision is to study the alert type and, if necessary, the LS results. The chart does not show what to look for but experience with NPDA will make such a decision almost intuitive.

The quick fix chart will not detect modem address switch problems nor streaming. It also does not always distinguish whether data errors are occurring on the telecommunication line or in the remote controller/terminal.

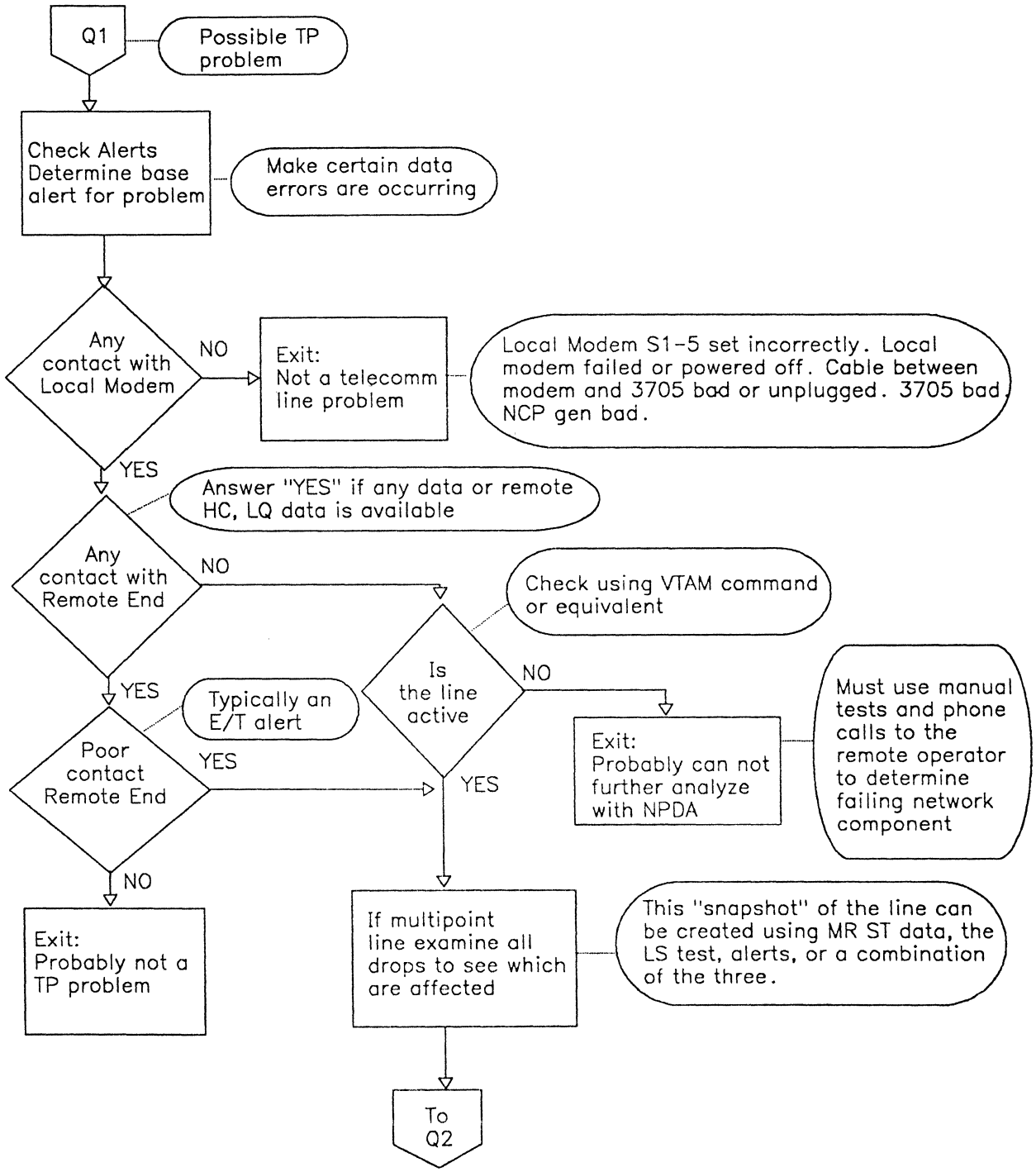


Figure 28. Quick Fix Flow Chart

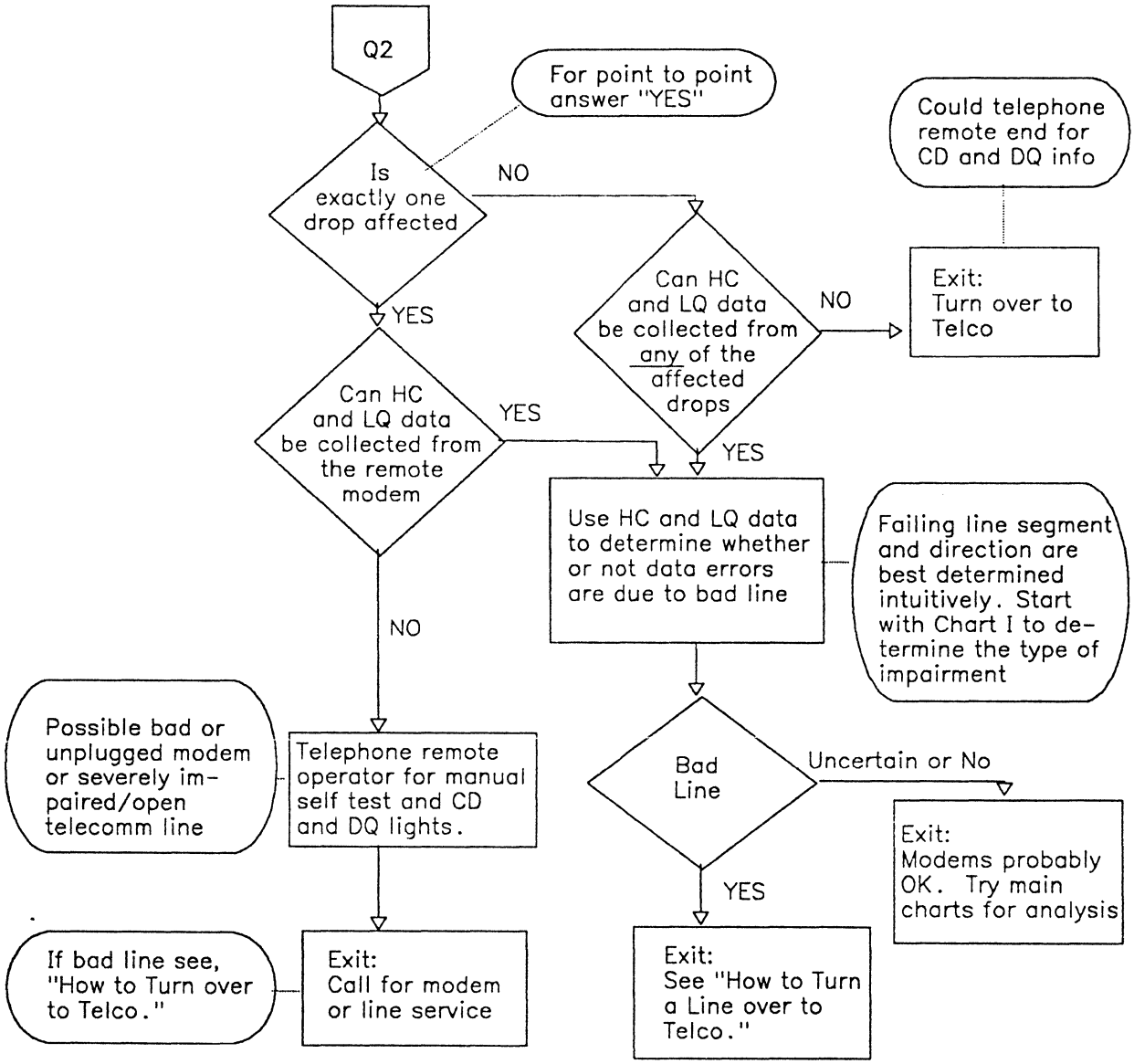


Figure 29. Quick Fix Flow Chart (continued)

CHAPTER 7: SHORT CUTS AND HINTS

WHEN TO SKIP FLOW CHARTS

If you know the line is open (the remote operator called and said the remote modem carrier detect light is off all the time), you are reduced to manual tests and analysis. Start at entry point D1 Figure 8 on page 22 for a multipoint line and at entry point E3 Figure 11 on page 25 for a point-to-point line. If for some reason, multipoint line segment determination is unimportant, entry E3 can be used for multipoint lines also.

If an LS test to one or more drops gives remote numerical data (as opposed to "data invalid - no response"), or if you know that the NPDA additional most recent data screen has numerical remote HIT and LQ data during the time of the alert, then the telecommunication line is not open and you can collect information from at least some of the remote modems. Start at entry point D1 Figure 8 on page 22.

If the telecommunication line is point-to-point (has only one remote modem), then from the exit point of chart F or G, go directly to chart I rather than back to chart E. See Figure 12 on page 26. Also, as indicated earlier in "Which Flowcharts to Use" on page 11, for point-to-point lines chart H should be skipped.

If the 3863, 3864, or 3865 modem type is known, skip Figure 15 on page 29. Many customers use only one modem type which would allow them to discard Chart I and whichever of charts J through P do not apply to their network.

For a moderately experienced help desk operator a typical set of charts to use in analyzing a problem would be D, E, F, H, and K. Five charts out of the fifteen. A later section shows how to reduce the number of flow charts even further. See "Using Intuition to Skip More Flow Charts" on page 49.

GETTING THE MOST OUT OF ALERT MESSAGES

Each NPDA alert message has a detail screen and a recommended action screen associated with the alert. It is often possible to understand the alert without using the extra screens by studying the alert message carefully. The alert message has two sections: a description and a probable cause. Many of the terms and phrases that NPDA uses are defined in the glossary at the end of this document.

There are several different failure areas that the descriptions can be grouped into.

- Protocol problems such as "Format Exception SDLC" or the more general "Communication Err" are very very unlikely to be caused by modem or telecommunication line errors. They suggest some form of software incompatibility between the central site and the remote controller/terminal unit.

- "Remote modem - no response" is unlikely to have been caused by a controller/terminal failure.

- "Remote modem - bad response" is very likely to have been caused by a telecommunication line problem.

For both types of "remote modem" alerts, if several drops on a line generate the same alert at the same time, the chances are excellent that the telecommunication line is impaired since the communication line is the one network entity common to all drops. The point is that an alert description, although compact, is informative. If you see one that you don't understand completely, check the glossary. If the glossary doesn't help, ask an IBM representative. Every help desk operator should have at least a general understanding of all the alert descriptions. It will pay off in faster diagnosis and repair of network problems and better network management.

The probable cause section of the alert is shorter and therefore even more cryptic than the description section. In NPDA terms,

- "Device" and "Secondary" refer to remote controllers and terminals and include the cable connecting the controller/terminal to the remote modem.

- "Remote Modem Interface" refers to the digital, not the analog, side of the modem and extends from the "A1" card in the modem out through and including the cable connecting the modem to the controller/terminal and into the controller/terminal itself.

Finally, the "Error to Traffic Ratio Exceeded" alert can appear by itself or it can appear together with some different alert posted against the same controller. Its meaning is different in the two cases.

If "E/T exceeded" is posted by itself it shows the system can contact the remote end and can still communicate and exchange data with the remote terminal and the remote modem, but when the system reached the routine traffic count (see "NCP Gen Parameters" on page 53), it collected the modem data and computed the error to traffic ratio (number of retries divided by the number of messages) which was excessive. The cause of the retries is unknown.

If the "E/T" alert is posted with another alert it means that the system found a problem as described by the other alert and, while trying to automatically analyze and recover from the problem, found that the E/T ratio was excessive.

The error to traffic alert can be used to warn network operators of potential problems before they are too serious. We recommend setting the threshold as low as possible but without saturating the alert screens with E/T alerts. Usually 1-2% is practical.

USING INTUITION TO SKIP MORE FLOW CHARTS

Flow charts F, G, and H Figure 12 on page 26 which are used for line direction (side) and segment (leg) determination are more than common sense but not much more. An experienced network help desk operator will probably make both determinations by glancing at the alert analysis sheet. Please re-use the charts from time to time to refresh your memory about the special cases described in the charts but for average problems, you probably will be able to stop using those three charts.

Sometimes the HIT and LQ information on a screen is crystal clear for a good or bad telecommunication line. Under those circumstances, charts I through P can be skipped. Again, we suggest you continue to use the complete flow chart package at least occasionally to insure the special situations described in the notes are fresh in your mind.

At the end of an earlier section, "When to Skip Flow Charts" on page 47, the number of flow charts used to analyze a "typical" problem had dropped to five when a moderately experienced person was using the flow charts. When a very experienced person uses the charts, only D and E might be required. That is, two out of fifteen.

Of course, there will be problems for which you will be glad to have the complete package. There may be situations when all fifteen flow charts will not identify the failing entity (which is the reason for the next chapter "Chapter 8: The Procedure Does Not Seem to Work" on page 51).

USING HALF SPEED TO GATHER BETTER DATA

Half speed is traditionally a way of improving data throughput by reducing retries with a highly impairment immune link although slow method of transmission. The IBM 3863, 3864, 3865 modems improve half speed's usefulness further by reporting different HIT and LQ numbers at half speed rather than at full speed. For example, a 3865 modem at 9600 BpS might be reporting HIT=16 per 15 minutes and LQ=10 consistently. At half speed on the same line the same modem might report HIT=2 per 15 minutes and LQ=7. At full speed it is very difficult to decide whether the impairment is of the intermittent or steady state variety but at half speed the decision is simple. Sometimes the line segment determination is simplified in a similar way.

Use half speed. Changing the central site modem from full speed to half speed automatically changes all the remote modems' speeds. The change to half speed or back to full speed should not be detected or responded to by the central site hardware and software except for a few retries.

CHAPTER 8: THE PROCEDURE DOES NOT SEEM TO WORK

I CANNOT BRING THE LINE UP

MODEM CONFIGURATION SWITCHES

At the rear of every 3863, 3864, 3865 modem are two banks of small rocker switches. The left most bank of eight switches control much of the modem's behavior. If the configuration switches are at fault in a station where the line will not remain up, the usual cause is switch S1-5 set down when it should be up. The table below shows a typical setting of the switches for the various modem types but some of the switch settings are installation dependent. For more details see the User's Guide or Maintenance Information Manual (both are shipped with each modem).

	SWITCH NUMBER AND SETTING							
MODEM TYPE	1	2	3	4	5	6	7	8
3863/4-1 Central Site	D	U	*	U	U	U	D	D
3865-1/2 Central Site	D	U	U	U	U	U	D	U
3863/4-1 Remote Site	D	U	*	D	D	U	D	D
3865-1/2 Remote Site	D	U	U	D	D	U	D	U

* Down for multipoint - Up for point-to-point.

OTHER

When VTAM or equivalent will not bring the line up to the point where NPDA can communicate with the modems, if the problem is not S1-5 on the central site modem, then it is probably somewhere between the communication controller and the central site modem. The most likely component to fail in that link is the cable itself usually by being unplugged. If the central site modem is powered on and passes self test, the only two possible failures in it are the A1 card and the mother-board. The communication controller driver card could also be bad. Probably the simplest way to isolate this type of problem is with a breakout box.

The NCP gen could be incorrect. For more information see "NCP Gen Parameters" on page 53.

FLOW CHART ENTRY

When NPDA can not gather data for any reason, then your only recourse is to use the modem's manual test capabilities. There are two possible flow chart entries which include manual tests: B2 and E3. B2 is the better choice when the problem is likely to be at the central site as when the line can not be brought up. If

the system can contact the central site modem, then the manual tests of entry E3 are better.

I CANNOT GATHER DATA

NO ALERT

If you feel confident a problem is occurring, but no alert has been posted, you can get into the flow charts at entry B1. Be cautious. NPDA will normally post an alert. NPDA could be down. The Error to Traffic alert ratio could be set too high. The NCP Gen parameters could be inappropriate.

MODEMS

If the modems are not IBM 3863, 4, or 5 or if the NCP is instructed that the modems are not 3863, 3864, 3865, then you can not run an LS test nor gather additional most recent statistical data.

MODEM ADDRESS SWITCHES

If the 3863, 3864, 3865 modems in a network believe they are multipoint modems (3863/4 when the configuration switches are set appropriately and 3865-2) then they respond to the NPDA test commands only if the address in the command matches the front panel address switches. Point-to-point modems ignore the command's address.

Suspect an address switch problem if any of the modems in a multipoint network have blanks in both the local and remote portions of the additional most recent statistics screen. You can be certain that there is an address switch problem if one or more of the drops shows blanks in both the local and remote portions of the additional most recent statistics screen when the posting was because of a routine traffic count and the E/T was low (under 1%).

The "all blanks" condition occurs when no modem responds to a test command and when two or more modems respond to the same test command. Naturally, two modems in a network should not have the same address. There is a second case when two modems will respond to the same test command related to the fan out option.

> When a modem is set to X0 it will respond to addresses X0, X1, X2 and X3 where "X" is any digit. There is a legitimate reason for using an X0 address related to the fan out option but if the NCP Gen is set up correctly, no network will specify a modem address of X0 with X1, X2, or X3 assigned to a different modem.

If you see an "all blank" condition, check with the remote operator to see if the modem's address switch agrees with the NCP Gen. If it does, then a second modem in the network is responding to the same command. Check the additional most

recent statistics screens for the other controllers on the line to find the modem that is set incorrectly.

NCP GEN PARAMETERS

There are several NCP parameters that affect your ability to manage the telecommunications network. The most serious is the LPDATS operand in the LINE macro. LPDATS=YES is necessary when NPDA is to be used effectively with IBM 3863, 3864, 3865 modems.

Several operands can limit data collection. If the ADDR operand in the PU macros are not chosen correctly, then some modems may not be able to report the HC and LQ data back to the control site. See "Modem Address Switches" on page 52. If the SRT operand in the PU or TERMINAL macro is set incorrectly, the system will collect data too often or not often enough. Overly frequent data collection can swamp your CPU and reduce network throughput while infrequent data collection limits your ability to manage the network. The routine traffic count information collection must occur at least once every 1.5 hours. We recommend that this collection occur no more often than once per 15 minutes. Try SRT=6000,50 as a first approximation. Once per hour is very convenient because the number of hits per 15 minutes is easy to calculate (simply divide by four). The figure of 6000 will have to be adjusted upward or downward depending on the line speed and the traffic characteristics. You will not be able to guarantee a precise interval either.

The ETRATIO operand (for NPDA V1) in the LINE macro determines the E/T ratio at which an alert is posted. It defaults to 3% which is very reasonable for a new network. Usually a more mature network could set the ETRATIO to 1% or 2% to warn the help desk operators earlier but not saturate the help desk with alerts. The ETRATIO operand is not needed in the NCP generation when using NPDA V2. NPDA V2 uses the SRATIO command.

The timing of when NCP stops retrying a line and declares that a permanent error has occurred is very important too. When NCP decides a permanent error has occurred, it collects data from the central site modem and a remote modem and passes the data to NPDA for problem determination analysis. NCP must wait more than 40 seconds but less than 3 minutes before making the decision. This is controlled with the RETRIES and REPLYTO operands.

When "streaming" occurs in a multipoint environment, initially at the central site every terminal on the line appears failing except the terminal which is streaming. The streaming terminal forces its modem to transmit continuously which disrupts every other remote modem's transmissions except its own. But after 40 seconds the remote modem stops transmitting and internally records the streaming condition (assuming the modem's anti-streaming switch is on). Before the 40 second timeout there is no record of the true cause of the failure, i.e. streaming. Thus the minimum length of time for NCP retries to last must be 40 seconds.

The other end of the retry period can be determined by understanding the modem "power loss detected" system. When a remote modem loses power its last action is to send a signal to the central site modem. The central site modem internally records its reception of the signal and stores that record for three minutes. If the NCP collects data from the central site modem before the three minute limit expires, then the NCP will get the record, otherwise the record is lost.

OTHER

The modem configuration switches can also limit or prevent data collection. See "Modem Configuration Switches" on page 51.

NPDA IS DOWN

You are reduced to manual tests. See "Flow Chart Entry" on page 51.

CANNOT ANALYZE THE DATA

MULTIPLE PROBLEMS

This document is written with the assumption that only one failure is occurring on one line at one time. This is normal in a statistical sense. But, however statistically unlikely, there will be times when multiple failures are underway at the same time. If the flow chart results make no sense, i.e. one controller seems bad on the local side while another controller shows poor remote HIT and LQ, then consider the idea of independent failures. If historical HIT and LQ data is available for the drops, you may be able to page back to a time when only one of the failures was present. Another possible cause of strange looking flow chart results is the address switch problem. An incorrect address switch setting can make one or more legs of a line look bad. See "Modem Address Switches" on page 52.

MULTIPOINT INBOUND CD LOSS

There is only one type of telecommunication line impairment that causes data errors but is not detected by the modems. If the Hit Count, Line Quality, and CDLST look good and the data errors are not coming from any other entity in the network, then the telecommunication line failure must be carrier dropout on the receive side for the central site (the transmit side for the remote site). This is only a possibility in a multipoint environment, IBM's point-to-point modems respond to and report inbound carrier loss. Although the multipoint modems do not report inbound carrier loss via the NPDA pipeline, the Loop/Xmit test will catch the problem. See "Loop/Xmit Test" on page 55.

FALSE REMOTE MODEM POWER LOSS

The modems equipped with the Extended Diagnostic Feature sometimes interpret a 350 Hz signal on the telecommunication line as an indication that a remote modem on the line has lost power. Excessive line noise with the appropriate spectral content will fool the system into believing a remote modem lost power.

THE TELECOMMUNICATION COMPANY DISAGREES

SHORT TESTS AND LONG TESTS

If the flow chart analysis shows the problem is an intermittent impairment or carrier drop, the telecommunication company must use an appropriate test to detect the problem. Specifically, their tests must measure impulse noise, hits and drop-outs.

DISAPPEARING PROBLEMS

When an impairment disappears, no telecommunication company can find the problem. However NPDA should show that the problem is gone if the telecommunication company believes there is no problem.

LISTENING TO THE LINE

Listening to the line is a cheap way to gather information about the line. Some line impairments such as cross-talk from voices or ringing sounds are easy to recognize by listening to the line.

LOOP/XMIT TEST

The loop/transmit test is a very powerful manual test which involves only the modems and telecommunication line. If the loop/transmit test fails, the probability is very high that either a modem or the line has failed. A controller could affect the results of a loop/transmit test, but only if the controller is streaming.

If a loop/transmit test runs well, then there is no possibility that the telecommunication line is bad and the only modem failure that could be occurring is card A1.

The loop/xmit test does not diagnose line segment failures nor line impairment class. It does an excellent job of determining the bad side/pair of the line. The real strength of the test lies in its ability to isolate the failing network entity.

If the test can not be established, especially at half speed, then either the line is severely impaired or open or there is a modem address switch error. See "Modem Address Switches" on page 52.

If the loop/xmit test can be established but shows a single blink of the modem check light at test start suspect a compander mismatch.

If the modem check light shows data errors at the central site but the central site data quality lights look good, then the problem is on the transmit side

from the central site. If the central site shows data errors with the modem check light and also poor data quality, then the impairment is on the receive side for the central site.

COMPANDER MISMATCH

Compander mismatch is a telecommunication line problem that is very difficult to detect. It causes data errors and blanks in the remote portion of the additional most recent statistics screen. The loop/xmit test will identify the problem. See "Loop/Xmit Test" on page 55.

CONFERENCE BRIDGES

When a telecommunication vendor provides a multipoint line, he can join the individual pieces of the line by using multipoint bridges or conference bridges. Multipoint bridges are what we expect. Use of conference bridges will result in an "all-master" situation and every modem on the link will hear every other modem. A transmission from tributary A could garble reception for Tributary B when a message from the central site was reaching Tributary B. 3863 modems can function on lines with conference bridges but 3864 and 3865 modems can not. A conference bridge problem shows up only on newly installed lines or lines that are being upgraded to a higher speed.

COULD THE LINE BE IN SPEC

Yes. It is possible for data errors to occur in other network entities. If you identify the telecommunication line as the source of the errors, the line could still be in spec especially if you are using 3865 modems at full speed. It is very unusual to have an in spec line cause as high as 1% E/T ratio when 3863, 4 modems or 3865 modems at half speed are installed on the telecommunication line.

DESPERATION

CONTACTING IBM

If these procedures identify a problem incorrectly or do not identify a problem at all, please ask your IBM representative to contact Department H69 in Raleigh. But before you do, collect the information required below.

INFORMATION REQUIRED TO CONTACT IBM

We will need to know the alert, the line snapshot information (such as the information on the Alert Analysis sheet), the line bridge points, Hit Count and Line Quality information from before the problem, the modem type, the configuration switch settings of the modems of interest, and the hexadecimal data from an LS test to any drop on the line. The hex data is 52 digits near the bottom of the screen.

APPENDIX A: ESTABLISHING A "BASE" SYSTEM

NORMAL NETWORK DATA

To establish "normal" or expected values for the various statistics reported by NPDA and used in the segment direction analysis procedure, it is required that the user get the "most recent link status", line quality, and hit count values for remote and local receive wire pairs for each station in the complete network.

This data is a historical base for all lines and stations and should be used as a point of comparison for current situation data. This historical data should be obtained once all lines, modems and stations are installed and operating satisfactorily. New historical data should also be obtained for all stations after any reconfigurations or network changes that could cause deviation in the expected "normal line performance".

This base line data should also be used for problem fix verification purposes once the reported problems have been corrected by the communication vendor and before returning the line or station to service.

ADDITIONAL REQUIREMENTS

Error and traffic thresholds are a trigger for the automatic statistics collection used with this analysis tool. To be most effective the E/T performance alert must occur before a permanent error or before the terminal operator/end user detect a performance problem. The setting of the NCP retry counter will determine the period of this notification. Traffic counters should be set to ensure statistics are gathered by NCP every 15-30 minutes when no errors are occurring. (Refer to NPDA Users Guide for additional detail.) Also see "NCP Gen Parameters" on page 53.

A detailed topology of your network, including all lines and bridge points is also required to more effectively report specific location of link problems to the communication vendor. Your communication vendor may or may not be willing to give you the information. It is to his advantage to do so.

NEWLY INSTALLED LINES

If the circuit that is failing is a newly installed line, the modem may be reporting high numeric LQ values (greater than eight) indicating poor line quality. This line failure is most probably caused by envelope distortion or attenuation distortion. These common types of "start up" problems are usually caused by communication vendor company equipment (namely line equalizers) which, when correctly adjusted will eliminate the problem. These early problems usually do not recur once the equalizers are adjusted by the communications vendor. Therefore, this situation is not considered in the flow charts or tables.

If a high number of temporary errors are occurring (i.e., exceeding the user set thresholds) and this is a new line or new modem installation problem the user should also check the modem configuration and address switches for the proper settings before taking any other diagnostic actions. Refer to the appropriate publication GA27-3216 or GA27-3218 Set Up Instructions and User's Guide for 3863, 3864, and 3865 detail on proper configuration switch settings. See also "Modem Configuration Switches" on page 51 and "Modem Address Switches" on page 52.

APPENDIX B: LINE PARAMETERS AND THEIR EFFECT

It should be understood that certain line parameters have an effect on other line parameters, e.g. amplitude hits have effect on noise and amplitude distortion. The interaction of all analog parameters at their current value, and their cumulative effect on data throughput (measured by data errors) are most important to the end user. This guide uses NPDA values for both Line Quality and Hit Count when determining the class of impairment, that may have caused the link problem.

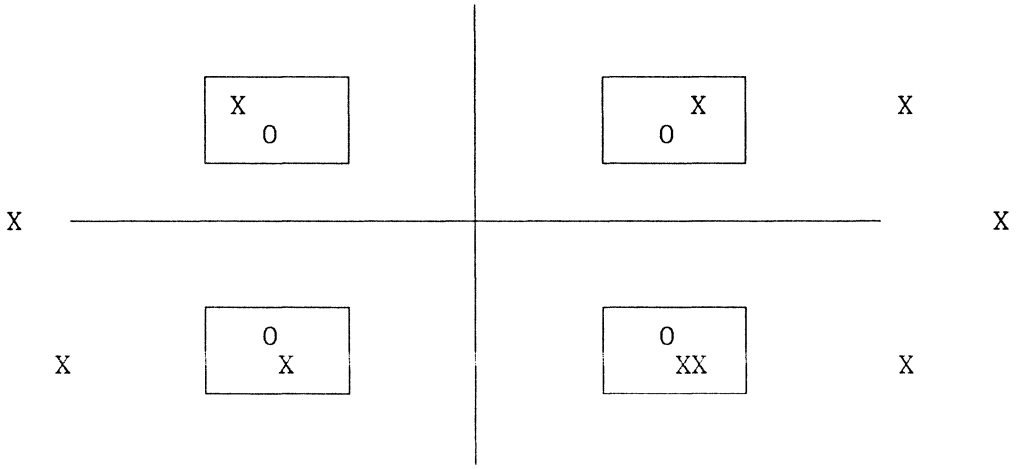
IBM MODEM DATA DEVELOPMENT

Measurements are made by the IBM 3863, 3864, and 3865 modems on "normal" data transmissions to better capture intermittent or transient problems. This technique is the same for all 3863, 3864, 3865 modems and is independent of the modulation scheme. Because of the powerful equalizers in the IBM 3863, 3864, 3865 modems there are many individual line impairments for which 3863, 3864, 3865 modems have high immunity.

The problem management philosophy for NPDA and 3863, 3864, 3865 modems is to avoid indicating the line as a probable cause if no errors are made in transfer of data over the link in question. This philosophy holds even if the value of an individual line parameter currently exceeds a tariffed or vendor procedural repair value.

The IBM 3863, 3864, and 3865 modems are relatively insensitive to phase jitter and frequency shift, singly or in combination, or to a point generally beyond the common carriers "operating practice" repair points. These characteristics and many others are not a part of the "tariff" for a 3002 unconditioned data transmission facility. Many of the other possible analog impairments both singly or in combination also may not cause errors in the data transmission. The line impairment effect is best evidenced by data errors or retransmissions not the current values of individual analog impairments.

The most valuable data in doing line analysis is measured on the received signals. Received Signal Measurement with the IBM 3863, 3864 and 3865 modem is based on the "eye pattern" or "line constellation" analysis which is a relationship between the theoretical target point for a received signal and the actual received signal. Eye pattern analysis by IBM 3863, 3864, 3865 modem yields two reported values, those of Hit Count and Line Quality. A line constellation figure for the 3864-1 is shown in Figure 30 on page 62. It shows a schematic representation of the Hit Count and Line Quality coverage.



HIT <0-63> - SIGNAL POINT OUTSIDE ACCEPTABLE RANGE

LINE QUALITY <0-15> - INBOUND SIGNAL QUALITY (MODEM)
NOISE, AMPLITUDE DISTORTION,
PHASE JITTER, ETC.

Figure 30. Amplitude-Phase Constellation Pattern

APPENDIX C: NPDA DISPLAY DEFINITIONS

A discussion of NPDA statistical data display fields follows:

	Additional Most Recent Field Heading
Hit Count	Hit
Line Quality	LQ
Carrier Detect Loss	CDLST
Modem Reinitialization	RINT
Data Rate	Data Rate
Switch Network Back Up Active	SNBU ACT
Link Type	Link Type

HIT COUNT DEFINITION (HIT)

The display field labeled Hit Count is derived from the value of a counter in the IBM 3863, 3864, 3865 modems. The IBM modems increment this counter by a maximum of one for every 256 baud time when one or more hits were detected. A hit is the occurrence of a received signal missing the expected target point by more than a predefined limit placing it outside the surface of field of interest described in the line quality section. The value of hit count is reset on readout by the unsolicited NPDA commands or solicited (operator invoked) NPDA commands.

The value of hit count is developed and maintained by the IBM 3863, 3864, 3865 modems and is retrieved by NCP whenever a counter (traffic or temporary error) overflows, and/or when a permanent error occurs, and/or when a controller is deactivated. Hit count will also be retrieved by NPDA solicited commands, but the value of counters will not be recorded on statistical data records.

A hit count accumulation value of up to 63 is kept by the 3863, 3864, 3865 modems in tributary or secondary configurations. The local modem Hit Count value can be either 1 or 0 under normal operation and is developed only on the full speed transmission of a special test message of 256 baud from the remote modem when the remote modem status is sent.

Hit counts can be caused by: (1) amplitude hits; (2) gain hits; (3) phase hits; and (4) line dropouts and other impairments not necessarily classified as hits. It should be noted that every hit does not always cause a data error, as the received signal may be correctly interpreted by the IBM 3863, 3864, 3865 modems.

The occurrence of hits shows a degrading line that should be monitored. Hits may cause data errors which can require retransmissions. True hits are typically a transient line problem and are usually not constant. Comparison of hit count values must be made with caution because the time periods of the accumulation is not constant as L/R status is not sampled based on time increments. The L/R samples depend on Error and Traffic Threshold overflows. See "NCP Gen Parameters" on page 53.

Hit count may also vary with the time of day. When reporting a line problem, the communication vendor should be told what time of day that the station is experiencing high hit counts.

A condition can exist where the NPDA display of local hit count is greater than one and there is an indication that no status data was received from the remote station. This situation occurs when a "local remote status test" was not executed by NCP or when no response to the request was received from the remote modem causing the local modem counters not to reset.

If the Local/Remote Status request fails, (no response) no status data will be transferred to the DTE by the local modem. On a short link status test (L/R status) no further action will be taken and both local and remote values will be blank on a MR ST Screen. In a Long Link Status when L/R status portion fails, NCP will issue a local status request. The LQ, HIT, CDLST and RINT values reported in the local status are not calculated from the transmissions from the remote modem of interest but are numbers from any other received transmissions since the last successful L/R status.

In a "bad response", NCP decided that a bad FCS (frame check sequence) was received with the records of a local or remote modem status. NCP will flag the results as invalid.

If the remote status is invalid NCP will issue a local modem status report. Again the local modem values of LQ, HIT, CDLST, and RINT are not related to the remote modem in question but are based on all data transfer after the last L/R status test. These situations would allow local modem values greater than 1 for Hit Count. The local (modem) hit counter is normally updated by receipt of a 256 baud full speed test message following or preceding the remote modem status message.

LINE QUALITY DEFINITION (LQ)

The Line Quality (LQ) display field represents a non-specific value for the demodulated signal or received line quality. It is a measurement of all residual errors but primarily of the noise parameters and non-linear distortion and other noise related parameters on the communication phone line that existed at the time of the sample. This LQ value is an average of the individual distances by which the actual received signals miss the theoretical target point. LQ is generally a 256 baud running average at the time of the sample and is expressed by values of 0 to 15.

The LQ value of 0 is equivalent to an ideal line with no impairment and a 16 dbm signal loss between transmitter and receiver. The LQ value of 8 has been empirically set to correspond to a transmission error rate of 1 error bit in 100 thousand bits of transmission when enough "white noise" impairs the received signal. The LQ of eight (8) is equivalent to a bit error rate of 10^{-5} .

The LQ value is of interest in characterizing the effects on data of all line impairments when aggregated together. It is therefore not an intrinsic parameter or characteristic of the line. The LQ value below 8 suggests that the line is running well and causing very few data errors while a value above 8 suggests the line could have caused a considerably high number of data errors. To determine the occurrence of data errors, refer to the NPDA error and traffic counts to determine if a high numeric value for line quality is indicating temporary or permanent problems as manifested by data error counts.

The remote modem LQ counter is an average value for the last 256 baud and the local modem LQ value is developed on the 256 baud test transmission sequence during the NCP/NPDA L/R status test. These values are reset by the successful

completion of the Local Remote status command sequence. If the L/R status fails (i.e., local modem does not receive remote modem status), there will be no data transferred to the DTE. The local modem LQ value will remain from the last data transmission received by the local modem. If the 256 baud test transmission sequence is not received but Remote Status is received, the local modem will force a LQ value of 15 in the local status and a HIT=0.

Poor (low) line quality (high values) can be caused by a bad signal/noise ratio, amplitude distortion, harmonic distortion, and phase jitter. As previously recommended the user should have determined what the "normal" line quality is for each of the stations in the network to compare the current LQ values and make a determination of line degradation.

Line quality values should remain constant. Changes in amplitude or harmonic distortion, phase jitter and steady noise are not normally instantaneous. These problems (impairment increases) usually show as a gradual buildup over a time and not as a sudden positive change in LQ values. Increasing values of LQ suggest degradation of the line, and do not necessarily result in immediate data errors.

Where there is a sudden upward change in the line quality value, it is usually caused by amplitude hits and amplitude distortion, which also effect the hit count. The user should analyze the LQ and Hit counters together to determine the type of problem that is causing the high line quality values. Note the change of a line routing by the communication vendor could also change the LQ and HIT values dramatically.

CARRIER DETECT LOSS (CDLST)

Carrier Detect Loss is an indication that the signal to the modem was missing for some period or that a noise burst of enough amplitude and duration caused the modem to lose synchronization with another modem on the line. In most cases, by analyzing the hit count and line quality for high values, the cause of carrier detect (CD) loss can be determined. The parameters that effect carrier detect are line opens, short opens called line dropouts (evidenced by no change in HIT and LQ but indicated positive CDLST) and extended high level bursts of noise (increased values of HIT and LQ).

Carrier Detect loss will cause error in data that will cause data retransmissions, i.e., E/T ratio or performance errors. At times if the signal is lost for long enough periods, it will also cause a permanent error.

It should be noted that in a multipoint network there is never a carrier detect loss posted for the (local) control modem since carrier is non-continuous on the inbound pair of wires. Carrier Detect Loss indications are only shown for continuous carrier configurations. The indicator is set by a loss or inability to recognize continuous carrier. The CD indicator is reset in the modem by L/R or L status completion and shows any change since last status command completion. Service speed changes do not result in CDLST indication.

REINITIALIZATION (RINT)

The display heading RINT is reinitialization. RINT shows that the 3863, 3864, 3865 modem had undergone a reinitialization or power on condition since the last time the counters were successfully retrieved by an L/R or L status test. The reinitialization could have been caused by either the local or remote modem having been powered off and then on again. This RINT indication would also be displayed by a yes or no if the 3863, 3864, 3865 modem had experienced an internal check during operation. Modem reinitialization is not caused by line based impairments and is not considered in the detail examination of line failures by this document.

The normal status of RINT is NO and anytime the status is YES you should determine the cause of the modem reinitialization. As with the CDLST, RINT is set at the time of the event and is reset by successful retrieval of L/R or L status test.

GENERAL

Other indications displayed by NPDA on the additional most recent data screen are:

1. Data Rate = Full or Half

   Full = data transfer operation at full rated speed, i.e. 2400, 4800, or 9600 bits per second

   Half = data transfer at 1/2 of rated speed, i.e., 1200, 2400, or 4800 bits/second.

2. Switch Network Backup Active = Yes/No

   YES = using a pair of 2-wire dial lines to back up a broken or otherwise unserviceable 4-wire leased line.

3. Link Type = BiSync or SDLC Line Control Indication

On NPDA Most Recent and Additional Most Recent Statistics screens "Local and Receive" Headings refer to the INBOUND circuit from the Remote Stations to the Host location while "Remote and Transmission" headings refer to the OUTBOUND circuit from the Host location to the Remote Stations.

APPENDIX D: NPDA SCREEN USAGE

Figure 31 on page 68 through Figure 35 on page 70 show NPDA screen examples of data that are used in the process of determining line location segment and/or class of impairments. It is assumed the user is familiar with the concepts of NCP solicited and unsolicited data collection and test requests.

1. Figure 31 on page 68

   ```
   Command Sequence Enter ...
   NPDA MR ST N CTRL   station name
   ```

   From this screen the user may go directly to Figure 32 on page 69 or Figure 33 on page 69.

2. Figure 32 on page 69

   ```
   Command Sequence Enter ....
        NPDA A
        available from Most Recent Statistics Screen
   ```

3. Figure 33 on page 69

   ```
   Command Sequence Enter ....
       NPDA MR EV N CTRL
            events for station
       NPDA MR EV N Line
          events for line
   ```

4. Figure 34 on page 70

   ```
   Command Sequence Enter ....
       NPDA TOTAL ST N          NCP Name
       NPDA TOTAL ST T          Line Name
   ```

   The user may go directly to event or line detail from the screen.

```
NPDA-51A      *MOST RECENT STATISTICS DATA*              PAGE 1 of 1
                 *FOR SELECTED RESOURCE*
                BSC/SDLC STATION WITH 3863, 3864, 3865

DOMAIN  TYPE  RESNAME  TYPE  RESNAME  TYPE  RESNAME
NCCF2   COMC  NCPA1    LINE  A20L     CTRL  A20C
-------------------------------------------------------------------------
           TOTAL   TOTAL  ERR/TRAFFIC TRANSMISSIONS  RECEIVES
DATE/TIME  TRAFFIC TEMPS  SET  DATA   TRAFFIC ERRORS TRAFFIC ERRORS

01/27 16:47  65460     3  3.0    .0     32769      3   32691      0
01/27 13:47   9987     0  3.0    .0      5003      0    4984      0
01/27 13:30   6131     0  3.0    .0      5003      0    1128      0
01/27 11:49   1615    36  3.0   2.2       841     36     774      0




 ENTER 'A' (ADD'L MOST RECENT) OR 'EV' (EVENT)

 ???
 NPDA MRECENT ST N A20C
```

Figure 31. Most Recent Statistical Data

```
 NPDA-52A   *ADD'L MOST RECENT STATISTICAL DATA*       PAGE 1 of 1
                  *FOR SELECTED RESOURCE*
                     STATION WITH 3863, 3864, 3865

DOMAIN  TYPE  RESNAME  TYPE  RESNAME  TYPE  RESNAME
NCCF2   COMC  NCPA1    LINE  A20L     CTRL  A20C
-------------------------------------------------------------------
            DATA  LOCAL-LPDA-STATUS  REMOTE-LPDA-STATUS SNBU LINK
DATE/TIME   RATE  HIT LQ CDLST RINT  HIT LQ CDLST RINT  ACT  TYPE

01/27 16:47 FULL   0   5    NO   NO   0   1    NO   NO   NO   SDLC
01/27 13:47 FULL   0   5    NO   NO   0   1    NO   NO   NO   SDLC
01/27 13:30 FULL   0   5    NO   NO   0   1    NO   NO   NO   SDLC
01/27 11:49 FULL   0   5    NO   NO   0   1    NO   NO   NO   SDLC




 ???
 NPDA A
```

Figure 32. Additional Most Recent Statistical Data

```
 NPDA-41A          *MOST RECENT EVENTS*                PAGE 1 of 1
                  *FOR SELECTED RESOURCE*

DOMAIN  TYPE  RESNAME  TYPE  RESNAME
NCCF2   COMC  NCPA1    LINE  A20L
-------------------------------------------------------------------

SEL#  DATE/TIME   EVENT  DESCRIPTION=PROBABLE CAUSE          ETYP ACT

(1)   02/03 11:24 DSR ON CHECK=LOCAL MODEM OFF/LOCAL MODEM PERM 16
(2)   02/03 08:45 DSR ON CHECK=LOCAL MODEM OFF/LOCAL MODEM PERM 16
(3)   01/30 16:12 DSR ON CHECK=LOCAL MODEM OFF/LOCAL MODEM PERM 16
(04)  01/28 15:38 DSR ON CHECK=LOCAL MODEM OFF/LOCAL MODEM PERM 16
(05)  01/28 09:20 DSR ON CHECK=LOCAL MODEM OFF/LOCAL MODEM PERM 16




 ENTER 'ST' (STAT), OR SEL# (ACTION), OR SEL# PLUS 'D' (DETAIL),
 OR 'P' (PROBLEM)

 ???
 NPDA MRECENT EV N AAOL
```

Figure 33. Most Recent Events

```
 NPDA-50A        *TOTAL STATISTICAL DATA*                PAGE 1 of 1
                  *FOR SELECTED RESOURCE*

DOMAIN  TYPE  RESNAME
NCCF2   COMC  NCPA1
-------------------------------------------------------------------

                     **********TOTALS********** DAILY
SEL#  TYPE RESNAME TRAFFIC   TEMPS E/T     FROM       TO     E/T MR

(1)   LINE A20L    10061130  1335   .0 01/25 14:26 02/12 14:08  .0

(2)   LINE A24L      226179  5062  2.2 02/10 13:19 02/12 14:14 2.7



 ENTER 'EV' (EVENT), OR SEL# (ATTACHED)


 ???
 NPDA TOTAL ST T LINE
```

Figure 34. Total Statistical Data

```
 NPDA-BNIF16  *RECOMMENDED ACTION FOR SELECTED EVENT*  PAGE 1 of 1

DOMAIN  TYPE  RESNAME  TYPE  RESNAME
NCCF2   COMC  NCPA1    LINE  AA0L
-------------------------------------------------------------------

USER    CAUSED - LOCAL MODEM POWER OFF
       ACTIONS - CORRECT THEN RETRY

INSTALL CAUSED - NONE

FAILURE CAUSED - LOCAL MODEM
                 LOCAL MODEM INTERFACE CABLE
       ACTIONS - D022 - CHECK PHYSICAL INSTALLATION
                 D002 - RUN MODEM TESTS
                 D005 - CONTACT APPROPRIATE SERVICE REPRESENTATIVE


 ENTER 'D' TO VIEW DETAIL DISPLAY
 ???
 NPDA 1 A
```

Figure 35. Recommended Action

```
 NPDA-43B              *EVENT DETAIL*                    PAGE 1 of 1
                    *FOR SELECTED RESOURCE*
                          SDLC LINE

DOMAIN  TYPE  RESNAME  TYPE  RESNAME
NCCF2   COMC  NCPA1    LINE  AA0L
------------------------------------------------------------------

DATE/TIME: 02/03 11:24
OPERATION - ENABLE - SETS DTR AND MONITORS FOR DSR TO GO ACTIVE
PROBABLE CAUSE - MODEM INTERFACE FAILURE

ERROR DESCRIPTION - DSR-ON CHECK - FOR LEASED LINES,
DSR DOESN'T COME UP WITH 3 SECONDS AFTER DTR


FA9000A1 82050200 00000000 00003D00 000056F4 00000000 00000000
00000000 00000000 00C10000 00040000 0000000 00000000 00000000
1E00FC

 ENTER 'A' TO VIEW ACTION DISPLAY
 ???
NPDA D
```

Figure 36. Event Detail

```
 NPDA-24A        *LINK STATUS AND TEST RESULTS*          PAGE 1 of 1
                    *FOR SELECTED STATION*

DOMAIN  TYPE  RESNAME  TYPE  RESNAME  TYPE  RESNAME
NCCF2   COMC  NCPA1    LINE  AA0L     CTRL  A20A
------------------------------------------------------------------

LOCAL STATUS:  HIT=0      LINE QUALITY=5
      FULL SPEED

REMOTE STATUS: HIT=0      LINE QUALITY=1

SELF TEST RESULTS:
     LOCAL MODEM SELF TEST SUCCESSFUL



410384F8 3B100586 01E00000 00000201 00000010 00542080 910000

 ???
NPDA TEST NCPA1 A20A LS
```

Figure 37. Link Status and Test Results

5. Figure 37 on page 71

Command Sequence Enter ....

	Resource Name	Resource Name	
NPDA Test	NCP	Station	LS

The data retrieved by this and all operator solicited tests are not stored in the statistical data base records. All modem status indicators and counters are reset. This test will not execute, should another NPDA unsolicited test be in progress with the named resource.

This command will result in NCP issuing a long link status sequence consisting of LPDA commands for Local/Remote Modem Status Report and Local Modem Self Test.

APPENDIX E: SAMPLE PROBLEM

INTRODUCTION

This appendix contains an example of telecommunications problem determination using the techniques of this document. You will need to have a flow chart package (Charts A through P2) to follow the example. Please note that a flow chart package separate from the remainder of the document will save you time in your day-to-day work; by all means copy the charts and use them separately.

BACKGROUND

The Lastcall company has many leased telephone lines that reach from Corporate headquarters in Delaware to California. All the lines are multipoint with an average of five drops per line. The Lastcall company has had the wisdom to install 3865 model 2 modems on their lines. They have also cleverly installed fan out at as many locations as possible to minimize their telephone line costs.

We will look over the shoulder of help desk operator Ruth as she trouble-shoots a problem.

At 4:05 p.m. (1605), Ruth got a phone call from San Francisco. Her customer complained that response time was very slow. When Ruth turned on her terminal and logged on to NPDA, her Alert Dynamic screen showed Figure 38 on page 74.

```
NETWORK PROBLEM DETERMINATION APPLICATION          03/02/83 16:07:35
NPDA-30A                      * ALERTS-DYNAMIC *
DOMAIN: NCF11

  DATE/TIME  TYPE RESNAME ALERT DESCRIPTION: PROBABLE CAUSE
03/02 16:01 CTRL SANFRAN  ERROR TO TRAFFIC RATIO EXCEEDED:COMMUNICATIONS
03/02 15:54 CTRL SANFRAN  ERROR TO TRAFFIC RATIO EXCEEDED:COMMUNICATIONS
03/02 15:47 LINE L14043   MODEM ERROR: LOCAL MODEM OFF/LOCAL MODEM
03/02 15:41 LINE L24026   DSR ON CHECK: LOCAL MODEM OFF/LOCAL MODEM
03/02 15:31 CTRL CHI01    POWER OFF DETECTED: DEVICE OFF/DEVICE
03/02 15:31 CTRL BOS01    TIMEOUT: DEVICE OFF/REMOTE MODEM OFF/COMMUN.
13/02 15:31 3380 DDEV420  SEEK CHECK: DASD DRIVE
03/02 15:28 3420 TDEV241  DATA CHECK: TAPE DRIVE/MEDIA
03/02 14:03 PROG HDCM     ACCESS EXCEPTION-SECONDARY PSV: PROGRAM
03/02 09:02 COMC NO43F3M  UNDERRUN: COMMUNICATION CTRL/CTRL PROGRAM
03/02 09:02 LINE L24022   SELF TEST-NOT EXECUTED: LOCAL MODEM/INTERFACE
03/02 09:02 LOOP LP01     LOOP OPEN: LOOP
03/02 09:02 CTRL NYC04    POOR LINE QUALITY: LINE
03/01 18:46 ADAP PP52     "N" GROUP TIMEOUTS:DEVICE/COMMUNICATIONS

DEPRESS ENTER KEY TO VIEW ALERTS-STATIC


NPDA
```

Figure 38. Sample Alert Dynamic Screen

Ruth spotted the two alerts posted against SANFRAN but could not tell if any of the other alerts were related. Please note that she could have been working on the problem for 11 minutes before the call came in from San Francisco.

Ruth opened her package of flow charts and started her problem determination with Chart A. If you do not yet have your own package of flow charts, see Figure 4 on page 18.

She answered "yes" to the question about whether the alert is E/T Exceeded and then found that her next step was to do a solicited link status test. The test command format requires the NCP name which Ruth did not know. To get the NCP name she ran a VTAM Display Net command - here the command was:

```
D NET,ID=SANFRAN,E
```

The response is shown below:

```
NETWORK COMMUNICATIONS CONTROL FACILITY          03/02/83 16:09:54

IST075I VTAM DISPLAY-NODE TYPE=PHYSICAL UNIT        (NCCF)
IST486I NAME=SANFRAN, STATUS=ACTIV      ,DESIRED STATE=ACTIV
IST081I LINE NAME=LSTCL04, LINE GROUP=TRANSN1, MAJ NOD=NCP1182
IST654I I/O TRACE=OFF, BUFFER TRACE=OFF
IST355I LOGICAL UNITS:
IST080I TERM471 NEVAC  TERM472 ACTIV  TERM473 NEVAC
IST314I END


???***
```

Figure 39. Sample VTAM Display Net Screen #1

Ruth saw that her problem controller SANFRAN is on line LSTCL04 which is in the NCP called NCP1182. She also can see that SANFRAN is active.

The screen also shows that the SANFRAN controller could have up to three terminals but has only one active terminal at that time.

Ruth issued the LS test command "NPDA TEST NCP1182 SANFRAN LS" and got the results shown in Figure 40.

```
NETWORK COMMUNICATIONS CONTROL FACILITY         03/02/83 16:13:08 A
NPDA-24A             *LINK STATUS AND TEST RESULTS*      Page 1 of 1
                        *FOR SELECTED STATION*

DOMAIN  TYPE  RESNAME TYPE RESNAME TYPE RESNAME
NCF11   COMC  NCP1182 LINE LSTCL04 CTRL SANFRAN
-------------------------------------------------------------------
LOCAL STATUS: HIT=1   LINE QUALITY=4
  FULL SPEED

REMOTE STATUS: HIT=63 LINE QUALITY=4


SELF TEST RESULTS:
  LOCAL MODEM SELF TEST SUCCESSFUL


41038408 14100586 01E00000 00000201 00C00C40 0444FC80 820000


??? ***
NPDA
```

Figure 40. Sample Link Screen #1

The flow chart says the time of the LS test must be recorded so Ruth got out a blank Alert Analysis Sheet (see "Alert Analysis Sheet" on page 15) and began filling it out. See Figure 41 on page 76 for her results.

1) Alert Date/Time/Description 03-02 15:54 E/T EXCEEDED

2) Alert Resname Controller SANFRAN

3) Time of LS test 16:13 Line LSTCL04 Telco Line Number

2,4) Controller Names	VTAM Status	5,6) E/T	Additional Most Recent Statistical Data		
			Data Rate	7) Local HIT LQ CDLST RINT	Remote HIT LQ CDLST RINT 15 MIN

Figure 41. Sample Alert Analysis Sheet #1

As you can see, she did not record any hit count or line quality data. The next step for Ruth was to find entry point A3. You can find it on Figure 5 on page 19. The questions and answers Ruth used on the new chart are shown below. She used the LS screen Figure 40 on page 75 to decide the answers to the questions.

QUESTION	ANSWER
Response is "Function Not Available"	NO
Response is "Function Not Supported"	NO
Response is "Function Active"	NO
Response includes "Local Self Test Passed"	YES
"Bad Response" in Remote Portion of LS Screen	NO

Since the flow chart pointed to entry C1, Ruth located Chart C (Figure 7 on page 21) which has the entry. She answered the flow chart C questions as follows:

QUESTION	ANSWER
Response includes "DTR DROP DETECTED"	NO
Response includes "DTE POWER LOSS"	NO
"No Response" in Remote Portion of LS screen	NO

After she answered the questions on Chart C, Ruth turned to Chart D, Figure 8 on page 22 in this document, entry point D1. The first instruction on the chart said "Fill out the Alert Analysis Sheet". Ruth had read the instructions in "Alert Analysis Sheet Instructions" on page 14 so she did another VTAM Display Net command:

```
D NET,ID=LSTCL04,E
```

The results are shown below.

```
NETWORK COMMUNICATIONS CONTROL FACILITY          03/02/83 16:14:30

IST075I  VTAM DISPLAY-NODE TYPE=LINE                    (NCCF)
IST486I  NAME=LSTCL04  , STATUS=ACTIV     ,DESIRED STATE=ACTIV
IST087I  LINE TYPE=LEASED  LINE GROUP=TRANSN1
IST134I  MAJNOD=NCP1182
IST655I  LINE TRACE STATUS=TR RES  TG TRACE STATUS=TRRES
IST084I  NETWORK NODES:
IST089I  RAL01   TYPE=PHYSICAL UNIT              ,ACTIV
IST089I  TERM41  TYPE=LOGICAL UNIT               ,ACTIV
IST089I  RAL02   TYPE=PHYSICAL UNIT              ,ACTIV
IST089I  TERM42  TYPE=LOGICAL UNIT               ,ACTIV
IST089I  DESMOI  TYPE=PHYSICAL UNIT              ,ACTIV
IST089I  TERM44  TYPE=LOGICAL UNIT               ,ACTIV
IST089I  FLGSTFF TYPE=PHYSICAL UNIT              ,ACTIV
IST089I  TERM45  TYPE=LOGICAL UNIT               ,ACTIV
IST089I  BOISE   TYPE=PHYSICAL UNIT              ,ACTIV
IST089I  TERM46  TYPE=LOGICAL UNIT               ,ACTIV
IST089I  SANFRAN TYPE=PHYSICAL UNIT              ,ACTIV
IST089I  TERM471 TYPE=LOGICAL UNIT               ,NEVAC
IST089I  TERM472 TYPE=LOGICAL UNIT               ,ACTIV
IST089I  TERM473 TYPE=LOGICAL UNIT               ,ACTIV
IST089I  YAKIWAS TYPE=PHYSICAL UNIT              ,NEVAC
IST089I  TERM4A  TYPE=LOGICAL UNIT               ,NEVAC
IST089I  CHI01   TYPE=PHYSICAL UNIT              ,IINOP
IST089I  TERM4B  TYPE=LOGICAL UNIT               ,IINOP
IST314I  END


???***
```

Figure 42. Sample VTAM Display Net Screen #2

She could have found the names of the controllers on the line by looking at the line map, but the "Display Net" command also shows the VTAM status of each controller on the line. The Lastcall company's system programmers also cleverly named their logical units so that their NCP addresses appear in the terminal names. When Ruth got the "Display Net" results, she could see the correct addresses of each controller.

Ruth's next step was to record the controller names and status on her Alert Analysis Sheet. Her updated sheet is shown below as Figure 43 on page 78.

03-02 15:54 E/T EXCEEDED
1) Alert Date/Time/Description_____

SANFRAN
2) Alert Resname Controller_____

16:13 LSTCL04
3) Time of LS test_____Line_____Telco Line Number_____

2,4) Controller Names	VTAM Status	5,6) E/T	Additional Most Recent Statistical Data 7) Data Rate	Local HIT LQ CDLST RINT	Remote HIT LQ CDLST RINT 15 MIN
RAL01	ACT				
RAL02	ACT				
DESM01	ACT				
FLGSTFF	ACT				
BOISE	ACT				
SANFRAN	ACT	Y	FULL		
YAKIWAS	NEVAC	U			
CHI01	INOP	U			

Figure 43. Sample Alert Analysis Sheet #2

She entered a "Y" for San Francisco's E/T because she knew that in San Francisco the Error to Traffic threshold was exceeded. Also, Ruth entered "U" for the Yakima Washington site's E/T because she knew that a controller in the "Nevac" state has not had any message flow to or from the central site since the last time the Lastcall Company's VTAM was initialized. When no messages are being sent to or from a controller, there is no traffic and NPDA does not compute an E/T ratio. Thus an entry of "U" for unknown. Figure 40 on page 75 shows that this line was at full speed when the error occurred.

Ruth's next step in filling out the Alert Analysis Sheet was to return briefly to the NPDA Alert Dynamic screen using the NPDA ALD command. She did so but did not find any new alert relating to line LSTCL04 or any of the controllers.

Next Ruth had to use the NPDA most recent statistics screens to finish filling out the E/T column on the Alert Analysis Sheet. She looked at the SANFRAN drop first with the command NPDA MR ST N SANFRAN. What she got back is shown in Figure 44 on page 79.

```
NETWORK COMMUNICATIONS CONTROL FACILITY          03/02/83 16:16:05 A
NPDA-50A           * MOST RECENT STATISTICAL DATA *  Page 1 of 1
                        * FOR SELECTED RESOURCE *

DOMAIN TYPE  RESNAME TYPE  RESNAME  TYPE RESNAME
NCF11  COMC  NCP1182 LINE  LSTCL04  CTRL SANFRAN
-------------------------------------------------------------------------
               TOTAL  TOTAL  ERR/TRAFFIC  TRANSMISSIONS  RECEIVES
 DATE/TIME    TRAFFIC TEMPS  SET    DATA  TRAFFIC ERRORS TRAFFIC ERRORS

03/02 16:00    1562     50   3.0    3.2
03/02 15:54    1428     50   3.0    3.5       I G N O R E D
03/02 15:10    7999     40   3.0    1.5
03/02 14:15    8000     26   3.0    1.3
03/02 12:58    7999     21   3.0     .3
03/02 11:42    7999     34   3.0     .4
03/02 10:25    7999     23   3.0     .3
03/02 9:07     7998      3   3.0     .0
03/02 7:43     7999     18   3.0     .2
03/02 6:50     7999     38   3.0     .5
03/02 5:57     8000     19   3.0     .2
```

Figure 44. Sample Most Recent Statistics Screen #1

Ruth noted that the actual error to traffic ratio was about 3.5% and went on to the additional most recent statistics screen to gather more data about San Francisco. The command she used was NPDA A and the results were:

```
NETWORK COMMUNICATIONS CONTROL FACILITY          03/02/83 16:16:08 A
NPDA-52A        * ADD'L MOST RECENT STATISTICAL DATA *    PAGE 1 of 1
                      * FOR SELECTED RESOURCE *
                         STATION WITH 386X

DOMAIN TYPE  RESNAME  TYPE RESNAME  TYPE RESNAME
NCP11  COMC  NCP1182  LINE LSTCL04  CTRL SANFRAN
-------------------------------------------------------------------------
            DATA  LOCAL-LPDA-STATUS    REMOTE-LPDA-STATUS   SNBU LINK
 DATE/TIME  RATE  HIT LQ CDLST  RINT   HIT LQ CDLST RINT     ACT  TYPE
03/02 16:01 FULL   0   4   NO    NO     63  3   NO   NO       NO  SDLC
03/02 15:54 FULL   0   2   NO    NO     63  4  YES   NO       NO  SDLC
03/02 15:30 FULL   0   3   NO    NO     63  3   NO   NO       NO  SDLC
03/02 14:15 FULL   0   4   NO    NO     51  5   NO   NO       NO  SDLC
03/02 12:58 FULL   1   3   NO    NO     44  5   NO   NO       NO  SDLC
03/02 11:42 FULL   0   4   NO    NO     54  5   NO   NO       NO  SDLC
03/02 10:25 FULL   1   4   NO    NO     42  4   NO   NO       NO  SDLC
03/02  9:07 FULL   0   3   NO    NO     17  3   NO   NO       NO  SDLC
03/02  7:43 FULL   0   4   NO    NO     26  4   NO   NO       NO  SDLC
03/02  6:50 FULL   0   2   NO    NO     46  4   NO   NO       NO  SDLC
03/02  5:57 FULL   0   2   NO    NO     30  5   NO   NO       NO  SDLC


???***
NPDA
```

Figure 45. Sample Additional Most Recent Statistics Screen #1

Ruth's entries to her Alert Analysis Sheet from these two screens (Figure 44 on page 79 and Figure 45) are shown in Figure 46 on page 81. The entry to the analysis sheet is straightforward except for E/T, remote hit count, and remote carrier detect loss. Ruth entered "3.5 - 3.2" for E/T because both the 15:54 and the 16:01 time periods were included in the time when the problem was active.

The remote hit counter accumulated at least 63 hits in the 45 minutes from 14:15 to 15:30. This means that at least 21 hits occurred per 15 minute period on the average. Similarly, from 15:30 to 15:54, 63 hits occurred so the 15 minute rate was 39 hits per quarter hour. Finally, during the 7 minute period from 15:54 to 16:01 there were an additional 63 hits. This corresponds to 135 hits every quarter hour. Ruth entered the range of values for remote hit count of 21-135.

Ruth's entry for remote carrier detect loss shows that the remote modem reported occasional loss of carrier. Ruth then examined the "most recent statistics" screens and "additional most recent statistics" screens for locations RAL01, RAL02, DESMOI, and FLGSTFF. All four had very low E/T ratios so she entered "N" in the E/T column along with the approximate E/T ratio. However, she found that the "additional most recent statistics" screens were almost completely blank for three locations (RAL01, RAL02, and DESMOI). Ruth's entries are shown below.

1) Alert Date/Time/Description 03-02 15:54 E/T EXCEEDED

2) Alert Resname Controller SANFRAN

3) Time of LS test 16:13 Line LSTCL04 Telco Line Number

2,4) Controller Names	VTAM Status	5,6) E/T	Additional Most Recent Statistical Data								
			Data Rate	7) Local HIT	LQ	CDLST	RINT	Remote HIT	LQ	CDLST	RINT
								15 MIN			
RAL01	ACT	N .1-.2		BLANK							
RAL02	ACT	N .1-.2		BLANK							
DESMOI	ACT	N .1-.3		BLANK							
FLGSTFF	ACT	N .1-.7		OK							
BOISE	ACT										
SANFRAN	ACT	Y 3.2-3.5	FULL	0	2.4	NO	NO	21-135	3-5	Y/N	NO
YAKIWAS	NEVAC	U									
CHI01	INOP	U									

Figure 46. Sample Alert Analysis Sheet #3

The Boise, Idaho situation was not so simple as Ruth discovered when she looked at the Boise Most Recent Statistics screen shown below in Figure 47 on page 82.

```
NETWORK COMMUNICATIONS CONTROL FACILITY          03/02/83 16:23:05 A
NPDA-50A          * MOST RECENT STATISTICAL DATA *  Page 1 of 1
                      * FOR SELECTED RESOURCE *

DOMAIN TYPE  RESNAME TYPE  RESNAME  TYPE RESNAME
NCF11  COMC  NCP1182 LINE  LSTCL04  CTRL BOISE
-------------------------------------------------------------------------
              TOTAL  TOTAL  ERR/TRAFFIC  TRANSMISSIONS  RECEIVES
 DATE/TIME   TRAFFIC TEMPS  SET    DATA  TRAFFIC ERRORS TRAFFIC ERRORS
03/02 16:15   8000    143   3.0    1.8
03/02 15:08   8000     22   3.0     .3
03/02 13:43   7999     13   3.0     .2        I G N O R E D
03/02 12:37   8000     24   3.0     .3
03/02 11:13   7999     28   3.0     .4
03/02  9:58   7999     15   3.0     .2
03/02  8:41   7999      6   3.0     .1
03/02  7:24   7998     18   3.0     .2
03/02  6:09   7999     23   3.0     .3
03/02  5:11   7999      9   3.0     .1
03/02  3:42   8000     17   3.0     .2
```

Figure 47. Sample Most Recent Statistics Screen #2

```
NETWORK COMMUNICATIONS CONTROL FACILITY          03/02/83 16:24:08 A
NPDA-52A        * ADD'L MOST RECENT STATISTICAL DATA *    PAGE 1 of 1
                      * FOR SELECTED RESOURCE *
                         STATION WITH 386X

DOMAIN TYPE  RESNAME  TYPE RESNAME  TYPE RESNAME
NCP11  COMC  NCP1182  LINE LSTCL04  CTRL BOISE
-------------------------------------------------------------------------
              DATA  LOCAL-LPDA-STATUS    REMOTE-LPDA-STATUS   SNBU LINK
 DATE/TIME    RATE  HIT LQ CDLST  RINT   HIT LQ CDLST RINT    ACT  TYPE
03/02 16:15 FULL    0   3   NO     NO     63  3   YES   NO      NO  SDLC
03/02 15:08 FULL    0   4   NO     NO     63  3    NO   NO      NO  SDLC
03/02 13:43 FULL    0   4   NO     NO     47  4    NO   NO      NO  SDLC
03/02 12:37 FULL    0   2   NO     NO     49  5    NO   NO      NO  SDLC
03/02 11:13 FULL    0   1   NO     NO     48  5    NO   NO      NO  SDLC
03/02  9:58 FULL    0   3   NO     NO     29  5    NO   NO      NO  SDLC
03/02  8:41 FULL    0   4   NO     NO     21  5    NO   NO      NO  SDLC
03/02  7:24 FULL    0   2   NO     NO     36  3    NO   NO      NO  SDLC
03/02  6:09 FULL    1   3   NO     NO     38  3    NO   NO      NO  SDLC
03/02  5:11 FULL    0   3   NO     NO     40  5    NO   NO      NO  SDLC
03/02  3:42 FULL    1   4   NO     NO     48  5    NO   NO      NO  SDLC


???***
NPDA
```

Figure 48. Sample Additional Most Recent Statistics Screen #2

Her Boise entry on the Alert Analysis sheet is shown below.

03-02 15:54 E/T EXCEEDED
1) Alert Date/Time/Description_____

SANFRAN
2) Alert Resname Controller_____

16:13 LSTCL04
3) Time of LS test_____Line_____Telco Line Number_____

2,4) Controller Names	VTAM Status	5,6) E/T	Additional Most Recent Statistical Data 7) Data Rate	Local HIT LQ CDLST RINT	Remote HIT LQ CDLST RINT 15 MIN
RAL01	ACT	N.1-.2		BLANK	BLANK
RAL02	ACT	N.1-.2		BLANK	BLANK
DESMOI	ACT	N.1-.3		BLANK	BLANK
FLGSTFF	ACT	N.2-.7		OK	OK
BOISE	ACT	Y 1.8		0 3-4 NO NO	14 3 Yes NO
SANFRAN	ACT	Y 3.2-3.5	FULL	0 2-4 NO NO	21 3-4 Y/N NO 135
YAKIWAS	NEVAC	U			
CHI01	INOP	U			

Figure 49. Sample Alert Analysis Sheet #4

She entered a "Y" in the E/T column for Boise because of the discrepancy between it and the four other comparatively error free drops. The four "clean" tributaries had E/T ratios of .1 to .7. With Boise at 1.8, Boise is closer in performance to San Francisco than to Raleigh and Des Moines.

Since the Yakima, Washington site had never been activated, there had never been any traffic flow between it and the central site. This means no NPDA statistics. However Ruth could still collect modem data using the solicited link test command. (Its format was NPDA TEST NCP1182 YAKIWAS LS). She did and got back a remote modem "data invalid no response" message.

The other drop on the line is Chicago. Its VTAM status was "INOP" and the Alerts Dynamic screen (see Figure 38 on page 74) shows that at 15:31 the device attached to the modem apparently lost power. When Ruth did the VTAM "D NET" command of 16:14, the situation was unchanged. The alert message implies that the Chicago modem was still functioning even though the controller or terminal or printer etc. was not. Thus although there was no routine statistical data in the NPDA data base covering the period of interest (roughly 15:54), the Chicago modem might respond to the solicited link status command. Ruth issued the command (NPDA TEST NCP1182 CHI01 LS) and got the results shown below in Figure 50 on page 84.

```
NETWORK COMMUNICATIONS CONTROL FACILITY          03/02/83 16:28:23 A
NPDA-24A             *LINK STATUS AND TEST RESULTS*       Page 1 of 1
                        *FOR SELECTED STATION*

DOMAIN  TYPE  RESNAME TYPE RESNAME TYPE RESNAME
NCF11   COMC  NCP1182 LINE LSTCL04 CTRL CHI01
-----------------------------------------------------------------------
LOCAL STATUS: HIT=0   LINE QUALITY=2
  FULL SPEED

REMOTE STATUS:  HC=1  LINE QUALITY=2
 DTE POWER LOSS DETECTED  DTR DROP DETECTED


SELF TEST RESULTS:
  LOCAL MODEM SELF TEST SUCCESSFUL


41038408 14100586 01E00000 00000201 00C0042C  00242880 C30000


??? ***
NPDA
```

Figure 50. Sample Link Screen #2

Since the hit count and line quality figures are good, Ruth decided that the telephone line portion of her connection to Chicago was running well. Ruth's final Alert Analysis Sheet is Figure 51 on page 85.

03-02 15:54 E/T EXCEEDED

1) Alert Date/Time/Description_____

SANFRAN

2) Alert Resname Controller_____

16:13 LSTCL04 FDEA 73767

3) Time of LS test_____Line_____Telco Line Number_____

2,4) Controller Names	VTAM Status	5,6) E/T	Additional Most Recent Statistical Data								
			Data Rate	7) Local HIT	LQ	CDLST	RINT	Remote HIT	LQ	CDLST	RINT
				15 MIN							
RAL01	ACT	N.1-.2		BLANK				BLANK			
RAL02	ACT	N.1-.2		BLANK				BLANK			
DESMOI	ACT	N.1-.3		BLANK				BLANK			
FLGSTFF	ACT	N.2-.7		OK				OK			
BOISE	ACT	Y 1.8		0	3-4	NO	NO	14	3	YES	NO
SANFRAN	ACT	Y 3.2-3.5	FULL	0	2-4	NO	NO	21 135	3-4	Y/N	NO
YAKIWAS	NEVAC	U						NO RESPONSE			
CHI01	INOP	U		OK				OK			

Figure 51. Sample Alert Analysis Sheet #5

Most Alert Analysis Sheets are much simpler than this one. One key assumption in problem determination philosophies is that only one failure occurs at a time. In this example, it appears there are four problems:

- Lack of quantitative data from RAL01, RAL02, and DESMOI
- High E/T ratios from SANFRAN and BOISE
- "Never Active" condition on Yakima
- Loss of power in Chicago

We will concentrate on the San Francisco problem since it is the problem that prompted a telephone call from the user to Ruth.

After completing the Alert Analysis Sheet, Ruth returned to Figure 8 on page 22.

She made a mental note to review the address switch paragraph of the text. Next she checked the table and found that her correct answer was "NO" (the SANFRAN drop had 21-135 remote hits per 15 minutes which is more than the 15 allowed by the table).

She answered the remaining questions on Chart D as follows:

QUESTION	ANSWER
More than one drop active	YES
Only one CTRL has N for E/T	NO

Then she went to entry point E1 (see Figure 7 on page 21) and answered the questions:

QUESTION	ANSWER
At least one CTRL has "Y" for E/T	YES
CTRL with "Y" for E/T has numerical HC, LQ data	YES
"Normal data" available	NO

Ruth turned to chart G1 (see Figure 13 on page 27) and answered its questions

QUESTION	ANSWER
Does this controller have a "blank" for remote HC, LQ data	NO
Is remote or local LQ high (4 is less than 12)	NO
Either HC greater than 6 per 15 minutes	YES
Remote LQ is greater than local LQ	PROBABLY NOT
Remote HC is greater than 6 per 15 minutes	YES
Remote LQ is less than local LQ	NO
Local CDLST is YES	NO
Remote LQ equals local LQ	YES
Is the LQ high (4 is still less than 12)	NO

which completes Chart G. Ruth so far has learned that "the receive side for the remote modem is impaired (transmit side central site)". You might guess Ruth could have gathered the same information by studying the Alert Analysis Sheet thereby allowing her to skip Charts E and G. You would be right. For the San Francisco drop, clearly the "bad" line direction is the one associated with the remote results. Since all modem results refer to the receive side of the modem, we would say that the remote receive pair is impaired.

All the exits from chart G go to entry E2 (see Figure 10 on page 24). The instructions at E2 tell the operator to choose a second controller with high E/T and do the same impaired wire pair determination (transmit vs receive) that we did above using charts E (entry point E1) and G. Ruth would have picked the BOISE drop as her second choice and the analysis would have yielded, "the receive side for the remote modem is impaired (transmit side central site)" which is the same as the SANFRAN result.

After doing the line "side" determination algorithm twice, Ruth finished at entry E2 and left chart E to go to chart H after answering the questions below:

QUESTION	ANSWER
Checked two CTRL	YES
Results Agree	YES
Line Point-to-Point	NO

Chart H told Ruth to use a line map to determine the location of the line impairments. The LSTCL04 line map is shown below.

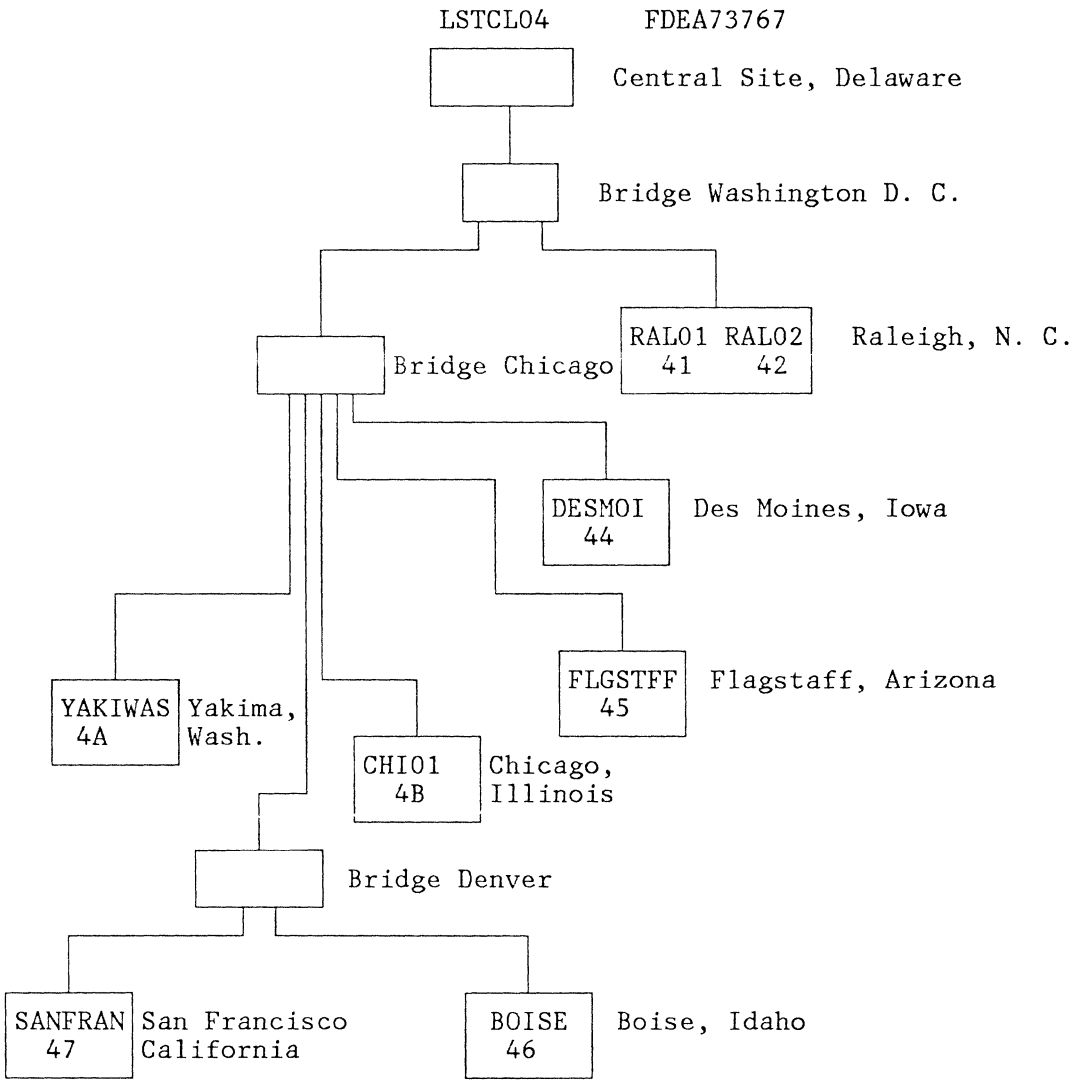


Figure 52. Sample Topological Line Map

The line map shows the way the 7 drops are connected to the central site. It also shows the drop and telco bridge (junction box to join two or more telephone lines together) location and the modem/control unit addresses. Since the San Francisco and perhaps the Boise Idaho drops are the only drops with high E/T, Ruth could see that the errors had to be occurring in the line segment connecting Denver to Chicago or perhaps the line segment connecting Denver to San Francisco if an E/T of 1.8% has been normal for the Boise drop. (historical data about the Boise drop would have been helpful.)

Line segment determination is very valuable to both customers and the telephone company. If Ruth told the telephone company that the failure was between Chicago and San Francisco on the pair transmitting data from Chicago toward San Francisco, the telephone company could have focused on the right area of the line without wasting time and could have fixed the problem without removing more than the SANFRAN and BOISE drop from service.

Ruth skipped chart I (Figure 15 on page 29) even though chart H points to chart I. She knew that all the modems in her network were 3865 model 2 and that the

impairment appeared in the "remote" section of the Alert Analysis Sheet. She jumped to chart P (Figure 26 on page 40).

Ruth answered the first questions on chart P "YES" and the second "NO". At this point Ruth must switch the line to half speed and collect additional HC and LQ data. While she does that, please look ahead in the flow chart. There are three possible exits from the chart. Note that they are final exits and do not point to any other flow charts. There are three decision blocks that will determine which will be an exit. We can deduce the answer to two of them. The full speed LQ reading was 3 to 4. LQ almost inevitably improves (i.e. decreases) when the speed of a line is decreased because at slower speeds, the modems can receive data more easily. So the half speed LQ will almost certainly be less than G. If you trace through what happens to the flow chart, the section we are interested in simplifies to one question: "Is the half speed HC=0?". Back to Ruth now.

Ruth changed the line to half speed and then immediately ran a solicited link status test to SANFRAN to reset the modem's hit counter. She waited five minutes (should have waited 15) and reran the test with the same format (NPDA TEST NCP1182 SANFRAN LS). The results are shown in Figure 53.

```
NETWORK COMMUNICATIONS CONTROL FACILITY          03/02/83 16:39:42 A
NPDA-24A              *LINK STATUS AND TEST RESULTS*       Page 1 of 1
                         *FOR SELECTED STATION*

DOMAIN  TYPE  RESNAME TYPE RESNAME TYPE RESNAME
NCF11   COMC  NCP1182 LINE LSTCL04 CTRL SANFRAN
-------------------------------------------------------------------------
LOCAL STATUS: HIT=0   LINE QUALITY=2
  HALF SPEED

REMOTE STATUS: HIT=12 LINE QUALITY=2


SELF TEST RESULTS:
  LOCAL MODEM SELF TEST SUCCESSFUL


41038408 14100586 01E00000 00000201 00C00820  00242880 C30000


??? ***
NPDA
```

Figure 53. Sample Link Screen #3

The existence of remote hits, even a mere 2, confirms that the impairment is of the intermittent type such as impulse noise. More importantly, since the full speed results certainly pointed toward an intermittent impairment, these half speed results suggest the impairment is probably out of the specification limits. Ruth called the telephone company and then switched the line back to full speed.

Ruth had completed her investigation of the original complaint, but she had two interesting loose ends left:

- "Blank" HC and LQ data from three modems
- Lack of Power in Chicago

Referring to her line map, see Figure 52 on page 87, Ruth deduced that one possible cause of the failure was incorrect modem address switch settings. She called the three sites and discovered that the Des Moines modem was set to address 40 rather than the correct 44. The failure mode was caused by the Des Moines modem failing to respond to a command sent to address 44 but responding to addresses 41 and 42 thereby garbling the responses from the Raleigh modem.

When Ruth called Chicago, the operator told her that the terminal appeared to be OK. Ruth then asked the operator to check the cable connection between the modem and the terminal. The Chicago operator found that one end of the cable was disconnected. (The modem responds identically to an unplugged cable and a terminal power off condition.)

So ends the story of the Lastcall company. If you have read this far, faithful reader, please be reassured that these procedures are not in practice as cumbersome as they seem on paper. Try them.

APPENDIX F: CLASSIFICATION OF LINE IMPAIRMENTS

Line operating characteristics can be divided into two areas - Line Continuity and Line Impairments. Line Continuity is determined in many different ways. The NPDA ability to retrieve remote status establishes continuity. The modem use of service speed (1200 bps) command exchange in the center of the communication channel band width maximizes the probability of establishing continuity. The extended diagnostic feature provides additional capability of understanding whether the line is open should the remote modem fail.

The second area, Line Impairments, deals with the ability of modems to exchange data over lines that are continuous but are imperfect in other ways. An example is the loss of signal (attenuation) because of the impedance of cables, wires and other components of the communication channel. This potential loss of signal is compensated for by amplifiers (repeaters). Non-switched modems are designed to transmit at 0 dbm and expect to receive at -16 dbm in the U.S. The IBM 3863, 3864, 3865 modems are capable of receive operation at levels as low as -43 dbm or -55 dbm or for high interference environments between -31 dbm to -36 dbm. Noise and other impairments modulated with the signals exchanged may degrade the receive level capabilities of the IBM 3863, 3864, 3865 modems.

All the various impairments fall into two large classifications: steady state and transient impairments.

Steady state impairments can be thought of as being always present and constant in level with any changes occurring over a long time. "Normal" values would be considered no more than one unit of change in the short run.

The common impairments assigned to the steady state classification include:

1. Phase Jitter
2. Frequency Shift
3. Attenuation Distortion
4. Delay Distortion
5. Broad Band Noise
6. Harmonic Distortion
7. Single Frequency Interference

Attenuation distortion and delay distortion are normally met as "new" line start-up problems. These communication vendor equipment problems are caused by line equalizers which when correctly adjusted eliminate the problem. Once set, equalizers do not fail often.

The IBM 3863, 3864, 3865 modems are generally impervious to severe amounts of phase jitter and frequency shift.

Testing by line analysis devices for these steady state impairments is generally accomplished in one minute or less and for attenuation and delay distortion not more than several minutes.

Transient impairments occur very rapidly, have a short period and can be very high amplitude. They can be present on a communication channel even in the absence of a carrier or signal. These transient impairments could occur at an extremely high repetition rate to appear equivalent to a steady state impairment.

The common impairments assigned to transient classification include:

1. Gain Hits
2. Phase Hits
3. Impulse Hits (Impulse Noise)
4. Line Dropouts

Testing by line analysis equipment for transient impairments will generally require 15 or 30 minutes to assure capture. Transient impairments can be very difficult to identify if they are extremely infrequent.

Hit count as reported by the IBM 3863, 3864, 3865 modems because it is a long term value and is based on analysis of full speed data signals is sensitive to transient impairments.

Line quality, since it is a short period (256 baud) measurement, is more sensitive to and an indicator of steady state line impairments.

Valuation of impairments and the measurements thereof as prescribed and practiced by the communications vendors is not by data exchange but rather single frequency and specified level tests.

The impairment flow charts use LQ, HIT, and CDLST indicators developed by the IBM 3863, 3864, 3865 modems on data transmission.

This second set of flow charts will classify the impairment into transient or steady state using the NPDA data and solicited tests where possible.

Impairment classification flow charts use the unsolicited NPDA data on the Additional Most Recent Statistics Screens if station and line are active. The data for impairment classification must be gathered by solicited NPDA link status test if only the line is active. If the line is not and cannot be activated, no reliable determination can be made of impairment classification.

Some Generalizations: If more than five retries occur in a 15-minute interval and NPDA probable cause shows "line" then the line is most probably out of spec.

1. High numeric values of LQ (Line Quality) with no or very low hit count suggest steady state impairment.
2. High hit count and/or CDLST along with good line quality suggest transient impairment.
3. High hit count and/or CDLST along with poor line quality suggest steady state impairment or highly repetitive transients.

It is desirable to have at least data records or solicited measurements for LQ, HIT, CDLST to succeed with problem analysis. The timing of these data points is no more often then five minute intervals, nor less frequently than hourly. Hit counts should be spaced on 15-minute intervals or normalized thereto. In using values in the flow charts observe the following:

1. Line quality values must equal target value given at least 65% of time, i.e., two out of three.
2. Hit count values must equal target value given at least 50% of time, i.e., more than one out of two.

Solicited data should be collected on intervals from five minutes to 15 minutes while the same is desirable for unsolicited data up to 1.5 hour intervals can be tolerated.

GLOSSARY

Add'l MR ST: Additional most recent statistic data from NPDA. Modem information such as Hit Count and Line Quality is posted on the add'l MR ST screen.

Back Bone: The portion of a telecommunication line that connects central office to central office without branches.

Base Alert: When multiple alerts occur because of a single problem, one of them will more accurately describe the problem. Usually extra alerts are of the E/T type.

BPS: Bits per Second. The data transmission rate of a modem or network.

BSC: Bi-sync. A communication protocol which allows for the re-transmission of messages when errors occur.

CD and DQ: Carrier detect and data quality lights which are on the front panel of each modem. They monitor the signal received by that modem.

CDLST: Carrier Detect Lost. An indication on NPDA screens that the referenced modem experienced a loss of carrier and turned off its carrier detect light.

Central: Site. Where polling originates. Usually location of the complex hardware.

Compander: Compresser-Expander. Used in pairs by telecommunication vendors to control the amplitude of signals on a telecommunication link. Boosts small signals and decreases large signals.

CTRL: Controller. Generic name for the physical unit (PU) at the remote end and the name for the associated modem. The modem responds to test commands that include the controller name.

Comc Controller: Communications Controller. Central site unit that controls central site modems. Usually a 3705.

Controller: See CTRL.

DBm: Deci-Bells in milliwatts. A unit of measure of the amplitude of a signal.

Device: An NPDA term referring to whatever hardware is attached to the digital side of a remote modem.

Direction of Failure: The wire pair or side of the telecommunication line that is impaired. For example, "the transmit pair/side from the central site".

DQ: Data Quality. See LQ.

Drop: Everything attached directly or indirectly to the remote end of a telecommunication line. Includes the modem, controller, terminal and any other hardware such as a printer. In NPDA terms, a CTRL.

DTE: Data Terminal Equipment. The device connected to the digital interface of a modem (excluding test equipment).

DTE Test: One of two NPDA tests that can be triggered by a help desk operator. Reports the status of the most important digital interface (to the DTE) leads as seen by the remote modem.

DTR drop: Data Terminal Ready Dropped. Shows abnormal behavior of the equipment attached to the remote modem. Under normal circumstances the DTR lead is always active.

E/T: Error To Traffic Ratio. Computed and displayed by NPDA. Number of retries divided by total number of transmissions.

Gen: Generation. The start-up of a NCP. Also the description of the network (modems, lines, terminals) to be run by the NCP.

HC: See HIT.

HIT: Hit Count. A number from 0 to 63 reported by IBM modems to describe the number of brief but severe line disturbances that had occurred since the last report.

Hz: Hertz. Cycles per Second. A measure of frequency.

Inbound: Signals that are being received at the referenced location. Without a location reference usually refers to the central site.

INFO: Information/Management. A way of keeping track of the progress of made in solving a problem.

Line Direction: See Direction of Failure.

Line Opens: Brief losses of carrier. Also called dropouts.

Line Segment: The identifiable portions of a telecommunication line. Each segment will carry a different combination of modem signals. Point-to-point lines have only one segment because all parts of the line carry the same modem signals.

Link: The telecommunication line. May or may not include the modems as part of the link. Somewhat context dependent.

Local Loop: In Telco terms the portion of the line that extends from a customer premise to the central office. In NPDA terms, the line segment (see line segment) that extends from the modem to the first bridge point.

Local Modem: In NPDA terms, the central site modem. In casual conversation, the modem closest to the speaker. Can be confusing.

Loop/Xmit Test: Loop Transmit Test. A manually originated test . The central site modem creates a loop condition with a remote modem and displays data errors as any occur.

LS Test: Link Status Test. A test originated at a NPDA keyboard. The test commands interrogate the local and a remote modem. Takes about 5 seconds.

LQ: Line Quality. A number from 0 to 15 that a modem uses to describe the quality of its received signal averaged over roughly a one second period. 0 is good. 15 is bad.

LU: Logical Unit. A functional block in remote controllers and some terminals.

MR ST: Most Recent Statistics. An NPDA screen used to display the E/T ratio of a remote drop. Also shows speed status of the line.

Multipoint: In NPDA terms, a line that uses 3865-2 modems or 3863 or 3864 modems with switch S1-3 down. In NCP terms, a line with multiple LU's (logical units) thereby forcing the use of a multipoint line protocol such as half duplex polling. In casual conversation, a line with more than one remote drop. Usually no ambiguity.

NCP: Network Control Program. Key program that contains a description of your network. Also defines limits, error retry procedures and general network performance parameters.

Normal: Historical HC and LQ data defining a line's characteristics when the line is running "normally".

NPDA: Network Problem Determination Application.

Outbound: Signals that are being transmitted away from the referenced location. Usually refers to central site.

Pair: Side. See Direction of Failure.

Point-to-Point: A line with exactly two modems if the modems are not 3865-2's. A line that has both CD lights on almost all the time. See Multipoint.

SDLC: Synchronous Data Link Control. See BSC.

Secondary: See Device.

SNBU: Switched Network Back-Up. A way for two modems to continue to exchange data after a failure of the normal leased telecommunication line.

Streaming: A condition in a multipoint environment when a remote modem transmits when it should not thereby garbling another modem's transmission. Can be controlled by using switch S1-7. Usually caused by a DTE problem.

S1-5: Modem configuration switch that controls how a modem responds to a test command on its digital (not telco) interface.

Telco: Telephone Company. A telecommunication vendor.

Telecom. Line: Telecommunication Line. The service purchased from a telecommunication vendor.

TP: Teleprocessing. Use of telecommunication lines to allow different locations access to computing power.

VTAM: Virtual Telecommunications Access Method. A program that controls the usability of a line by other software.

Xmit: Transmit.

3705: See Comc Controller.

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